FORE Systems PowerHub ATM Addendum
Software Version 7-2.6.4.0

MANU3015-01, Rev B, April 1997

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FORE Systems
1000 FORE Drive
Warrendale, PA 15086
Phone: 412-742-4444
Fax: 412-772-6500
Product Information:
Phone: 1-888-404-0444
Fax: 412-635-6325
Technical Support:
1-800-671-FORE
Internet: info@fore.com
or http://www.fore.com

COMPLIANCE WITH EMISSIONS AND SAFETY STANDARDS:
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. In addition, this product has been tested and found to be capable of operating within the specifications set forth under EN 55022 for Class A equipment. This product also complies with the provisions of EN 50082-1 relating to RFI, EMI, and ESD, which along with EN 60950 (see next paragraph) allows the product to carry the "CE" mark.

Tests performed by Inchcape Testing Services/ETL Test Laboratories demonstrate that this equipment meets UL 1950, CSA 950, and EN 60950 safety standards.

The emissions standards are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his or her own expense.

ABOUT THIS ADDENDUM

This addendum is for system administrators or others responsible for configuring the PowerHub model 6000 or 7000 to perform ATM switching. This addendum describes the PowerCell modules and the commands you use to configure them.

This addendum contains the following chapters:

Chapter 1 Overview	Describes the PowerCell hardware and software features.
Chapter 2 Installation	Describes the procedures for installing and testing the PowerCell module, and for configuring your FORE ATM switch to operate with the PowerHub system.
Chapter 3 LANE 1.0	Describes the PowerHub support for LANE 1.0.
Chapter 4 RFC-1483 Encapsulation over PVC	Describes the PowerHub support for RFC-1483 Encapsulation (RFC 1483). (PowerCell 700 only)
Chapter 5 Classical IP over ATM	Describes the PowerHub support for CLIP (Classical IP over ATM) as described in RFC 1577. (PowerCell 700 only)
Chapter 6 FORE IP	Describes the PowerHub support for FORE IP. (PowerCell 700 only)
Appendix A The ATM Commands	Describes the commands in the **atm** subsystem, which let you configure and manage the PowerCell module.
Appendix B Intelligent-Module Commands	Describes commands for testing the PowerCell 700, displaying and clearing local packet-processing statistics, and setting the watchdog timer.

OTHER BOOKS

You can find additional information about your PowerHub system in the following books:

PowerHub Software Manual, V 2.6 (Rev B or higher)
Describes the commands to configure the PowerHub system for bridging and IP routing. This manual also describes how to configure the PowerHub system to perform RIP routing and IP Multicasting, and how to set up bridge and route filters.

PowerHub Supplementary Protocols, Manual, V 2.6 (Rev B or higher)
Describes the commands to configure the PowerHub system for AppleTalk, DECnet, and IPX routing, as well as information on implementing IP Security.

PowerHub 7000 Installation and Configuration Manual, V 2.6 (Rev C or higher)
Describes the PowerHub 7000 hardware, as well as how to install it and how to upgrade it.

PowerHub 6000 Installation and Configuration Manual, V 2.6 (Rev B or higher)
Describes the PowerHub 6000 hardware, as well as how to install it and how to upgrade it.

For information about your FORE ATM switch, see the following books:

ForeRunner ATM Switch User's Manual
Describes how to install a *ForeRunner*™ ATM switch, a *ForeRunner*™ LAN or network module, and the accompanying *ForeThought*™ software.

ForeRunner ATM Switch Configuration Manual
Provides general ATM information. This manual also describes the commands to configure the *ForeRunner*™ family of ATM switches, the *ForeRunner*™ LAN and network modules, and the accompanying *ForeThought*™ software.

ForeRunner SBA-200 ATM SBus Adapter User's Manual
Describes how to install and configure the *ForeRunner*™ SBA-200 ATM SBus adapters and the accompanying software.

TYPOGRAPHICAL CONVENTIONS

The following typographical conventions are used in this manual:

This type style...	Indicates...
AaBbCcDd	A term that is being defined. Example: A *virtual circuit* is a unique connection between two ATM addresses.
`AaBbCcDd`	A command or argument name. PowerHub commands and arguments are case sensitive; they should always be entered as shown in the manual or on-line help. Example: **`showcfg`**
|	1) Separates the full and terse forms of a command or argument: • The full form is shown on the left of the **|**. • The terse form is shown on the right of the **|**. Example: **`showcfg|scf`** When you type the command or argument, you can type either the full form or the terse form. In this example, you can type **`showcfg`** or **`scf`**. 2) Separates mutually exclusive command arguments. Example: **`lec-set lecs-usage enl|dis`** In this example, the command **`lec-set lecs-usage`** can accept either **`enl`** or **`dis`**, but not both.
`<AaBbCcDd>`	Indicates a parameter for which you or the PowerHub system supplies a value. When used in command syntax, *`<italics>`* indicates a value you supply. Example: **`elan-del|edel`** *`<elan-name>`* In this example, *`<elan-name>`* is a parameter for which you must supply a value when you issue this command.

`AaBbCcDd` Indicates a field name or a file name.

A field name example:

When you boot the PowerHub software, the `login:` prompt is displayed.

A file name example:

When you boot the PowerHub software, the system looks for a file named `cfg`.

AaBbCcDd or **AaBbCcDd**

Indicates text (commands) displayed by the PowerHub software or typed at the command prompt. To make typed input easy to distinguish from command prompts and output, the typed input is shown in bold. Example:

```
1:PowerHub# pm view all 10 on 12
Port 10 (all) being viewed on: 12
```

In this example, you type "**`pm view all 10 on 12`**" and the software responds "`Port 10 (all) being viewed on: 12`".

Contents

1 Overview

ATM (Asynchronous Transfer Mode) is a high-performance technology for internetworking. ATM uses fixed-size cells to transport data, whereas current LAN technologies use packets that vary in size.

PowerHub models 7000 and 6000 provide ATM connectivity through the following hardware modules:

PowerCell 700	An intelligent NIM (Network Interface Module) installed in the PowerHub 7000 chassis.
PowerCell 600	A daughter card installed in slot 2 in the PowerHub 6000 chassis.

This chapter describes the PowerCell hardware and software features.

- For installation instructions, see Chapter 2.
- For information about specific ATM commands, see Appendix A.

The PowerCell modules contain the ATM PHY (physical layer) and ATM SAR (Segmentation and Reassembly) layers. The PowerCell 700 supports up to 32 logical segments. The PowerCell 600 supports up to 16 logical segments.

You connect to the ATM network by attaching the PowerCell module to an ATM switch, which in turn is connected to the ATM network. The PowerCell module is interoperable with FORE Systems' ATM switches. The PowerCell module also can be used with other vendors' ATM switches provided those switches also conform to the ATM Forum standards that the PowerCell module supports. For example, the other vendors' equipment must support the ATM Forum standards for LANE (LAN Emulation) 1.0 and UNI (User-Network Interface) 3.0 if you plan to use the equipment along with the FORE Systems PowerCell module in a LANE 1.0 network.

Some models of PowerCell module let you establish a redundant connection to the ATM switch. The redundant connection is provided by a redundant port (PHY) that automatically takes over if the connection to the primary port (PHY) fails.

1.1 REQUIREMENTS

To use the PowerCell modules, your system must meet the following requirements.

1.1.1 Hardware

Table 1–1 lists the hardware requirements for each PowerCell model.

TABLE 1–1 Hardware required for using PowerCell modules.

PowerCell Model	Packet Engine Required	Other Requirements
700	Rev 7, Issue 1 or Rev C, Issue 1	The Packet Engine must include the Packet Accelerator and 24 MB DRAM. To use a backup PHY (AMA), the AMA must be one of the following: • Rev D, Issue 3 or later. • Rev E, Issue 3 or later. • Rev H, Issue 1 or later. In addition, the PowerCell 700 must have at least 8 MB DRAM on the module itself.
600	Rev B, Issue 8 or Rev B, Issue 9 or Rev H, Issue 2 or higher	Packet Accelerator and 32 MB DRAM on the Packet Engine. In addition, the PowerCell 600 daughter card must be Rev C, Issue 0 or higher.

If you purchased your PowerHub system with the PowerCell module installed, your system already has compatible hardware.

To display the Rev and Issue of the PowerHub 7000 Packet Engine, use the **`main version`** command. (This command is described in Section 2.6.1 on page 34.)[1] To display the Rev and Issue of the PowerHub 6000 Packet Engine, use the **`mgmt idprom 1`** command. If your PowerHub system does not contain a Rev and Issue of Packet Engine that is compatible with the PowerCell module, contact the FORE Systems sales representative in your area.

1. You also can display the Rev and issue using the **`mgmt idprom`** command. See the “Management Commands” chapter in your PowerHub system’s *Installation and Configuration Manual*.

1.1.2 Software

Table 1–2 lists the software requirements for each PowerCell model.

TABLE 1–2 Software versions required for using PowerCell modules.

PowerCell Model	Software Type	Required Software Version
700	Packet Engine boot PROM	2.5.4 or later*
	System software	7-2.6.4.0**
	ATM boot PROM	7atp-1.1 or later
600	Packet Engine boot PROM	2.9.0 or later
	System software	6-2.6.4.0 or later
	ATM software	6atm-2.6.4.0 or later

* The Packet Engine boot PROM does not have to be upgraded in order to use the PowerCell model, However, FORE recommends that you use the latest released boot PROM to take advantage of any new features in the software supported by the PROM.

** Software versions 7-2.6.3.0, 7-2.6.3.1, and 7-2.6.3.2 support only LANE 1.0. FORE Systems recommends that you use the latest released software, even if you plan to use only the LANE 1.0 protocol.

In software version 7-2.6.4.0 and later, the ATM intelligent NIM retrieves its runtime information from the Packet Engine Flash Memory and not from the ATM runtime PROM. It is not necessary to upgrade the ATM intelligent NIM runtime PROM to run software version 7-2.6.4.0. See the *PowerHub 7000 7-2.6.4.0 Release Notes* for more information.

If you purchased your PowerHub system with the PowerCell module installed, your system already has the current software versions.

To display the installed software versions, use the **`main version all`** command. This command is described in Section 2.6.1 on page 34. If your hub is not running the current software versions, upgrade the software before attempting to use the PowerCell module. (See the Release Notes accompanying your system software for upgrade instructions.)

1.2 HARDWARE FEATURES

The FORE Systems PowerCell modules contain the following hardware features:

- AAL5 support.
- Support for up to 155 Mb/s.
- Choice of OC-3 or UTP interfaces. (The UTP interface is available only on the PowerCell 700.)

- Choice of single-mode or multimode fiber on the OC-3 interface (PowerCell 700 only).
- Traffic and status LEDs.
- Backup PHY that takes over if primary PHY fails.

You can install the PowerCell 700 in any NIM slot in the PowerHub 7000 chassis (except the one occupied by the Packet Engine). You also can install multiple PowerCell 700 Modules in the same chassis—up to four PowerCell 700s in a 5-slot chassis and up to nine PowerCell 700s in a 10-slot chassis.

The control features and the Ethernet and FDDI software features of the PowerHub models are described in the manuals listed on page iii. The ATM hardware and software features are described in the following sections.

1.2.1 PowerCell 700

The PowerCell 700 can contain one or two AMAs (ATM Media Adapters). An AMA is an on-board daughter card installed on the PowerCell 700. Each AMA provides a single physical port for connection to an ATM switch. (See Figure 1–1 for an example of an AMA.)

Using PowerHub software commands, you can configure up to 32 logical segments on the port. You can configure each logical segment for one of the following protocols:

- LANE (LAN Emulation) 1.0.
- RFC-1483 Encapsulation over PVC (Permanent Virtual Circuit).
- Classical IP over ATM (RFC 1577).
- FORE IP.

Figure 1–1 shows the front panel of the PowerCell 700. The PowerCell 700 shown in Figure 1–1 contains both a Primary AMA and a Backup AMA.

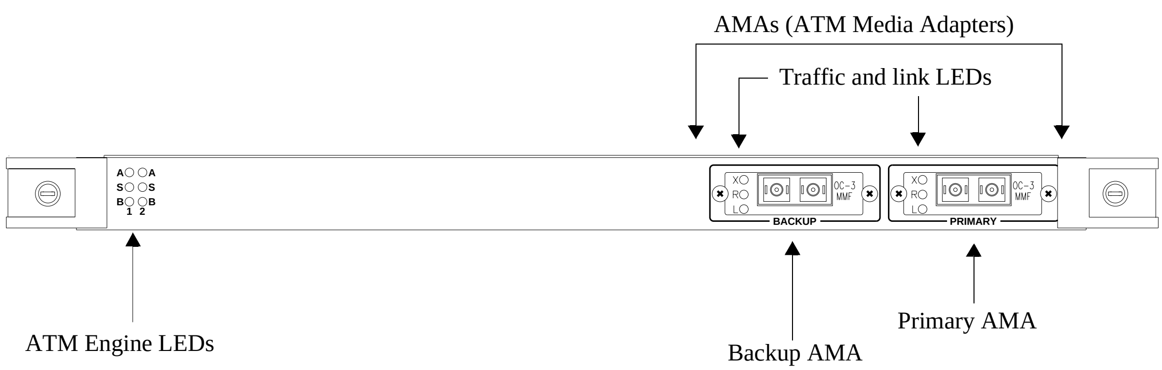


FIGURE 1–1 PowerCell 700 (front view).

The PowerCell 700 contains a single SAR (Segmentation and Reassembly) chip and can contain one or two PHY (Physical Layer) chips. Each PHY is contained in an AMA (ATM Media Adapter), an on-board daughter card. You can order the PowerCell 700 with a single AMA (primary only) or with two AMAs (primary and backup). If you order the PowerCell 700 with only a primary AMA, you can order a second AMA later to install as a backup. Contact FORE Systems TAC for information.

The operation of the backup AMA is described in Section 1.2.3 on page 6.

Four types of AMA are available for the PowerCell 700. The AMA types differ according to the physical interface. The PowerCell 700 AMAs are described in the following sections.

1.2.1.1 OC-3 AMA

Figure 1–2 shows the front view of the OC-3 AMA. The OC-3 AMA provides up to 155 Mb/s of bandwidth.

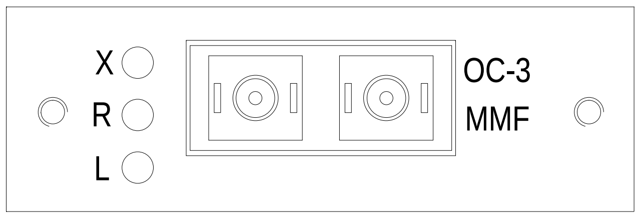


FIGURE 1–2 OC-3 AMA (front view).

The OC-3 AMA connects to a pair of fiber-optic cables with an SC connector. You can install a single-mode OC-3 AMA or a multimode OC-3 AMA depending upon the cable type in your network.

The traffic LEDs (X, R, and L) are described in Section 1.2.4 on page 7.

1.2.1.2 UTP AMA

Figure 1–3 shows the front view of the UTP AMA. The UTP AMA provides up to 155 Mb/s of bandwidth.

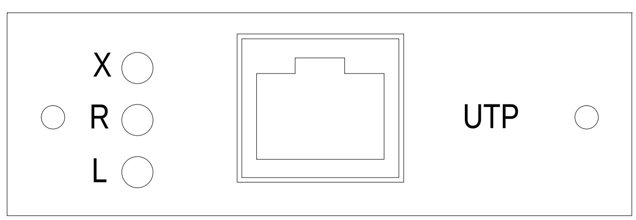


FIGURE 1–3 UTP AMA (front view).

The UTP AMA connects to a UTP cable using an RJ-45 connector. The pinouts for the connector are listed in Table 2–1 on page 48.

The traffic LEDs (X, R, and L) are described in Section 1.2.4 on page 7.

1.2.2 PowerCell 600

The PowerCell 600 is a stand-alone daughter card that is installed on the Packet Engine of the PowerHub 6000 chassis. You can use PowerHub software commands to configure up to 16 logical segments on the PowerCell 600. You can configure each logical segment for LANE (LAN Emulation) 1.0.

The PowerCell 600 contains a single SAR and can contain one or two ports (PHYs). You can order the PowerCell 600 with a single port (primary) or with two ports (primary and backup). Figure 1–4 shows the front panel of a PowerCell 600 module containing a single port.

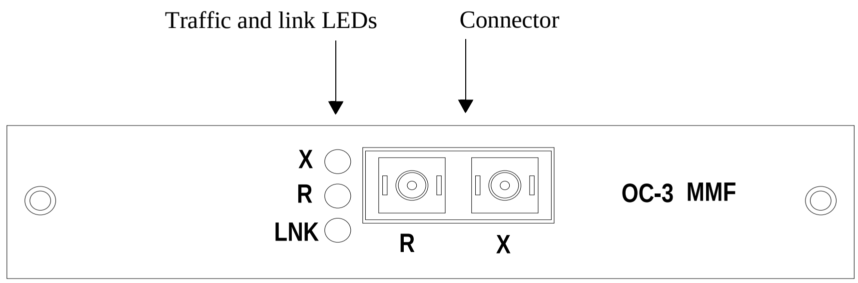


FIGURE 1–4 PowerCell 600 with a primary port (front view).

The PowerCell 600 can be ordered with an OC-3 connector for single-mode or multimode fiber-optic cable. The PowerCell 600 shown in Figure 1–4 contains an OC-3 multimode fiber connector, indicated by the label OC-3 MMF.

The PowerCell 600 is installed in slot 2 on the Packet Engine. In most configurations, the ATM segments are numbered 13 through 28.

You can display the chassis configuration and segment number ranges using the **`mgmt showcfg`** command. (See Section 2.8 on page 37.)

Figure 1–5 shows a PowerCell 600 with two ports, a primary port and a backup port.

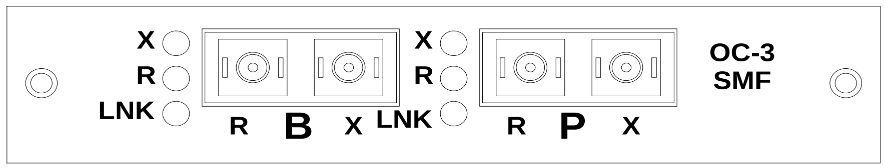


FIGURE 1–5 PowerCell 600 with a primary port and a backup port (front view).

The operation of the backup port is described in Section 1.2.3.

1.2.3 Backup Port

In a PowerCell module that contains two ports, the primary port is used for network traffic and the backup port automatically takes over if the link on the primary port fails. You do not need to perform any software configuration on the PowerHub system to set up the backup port. (If you need to perform configuration steps on the ATM switch, the steps are described in this manual.)

The PowerCell 700 lets you install or remove ports separately. Therefore, if you have a PowerCell 700 that contains only one port and you want to add a backup port, you can install an additional port on the PowerCell 700 module. Contact FORE Systems TAC for more information.

The PowerCell 600 modules are stand-alone daughter cards. To add a backup AMA, you need to remove the PowerCell 600 with the single port and replace it with a PowerCell 600 containing two ports. See Section 2.4 on page 27 for instructions.

1.2.4 Traffic and Link LEDs

The PowerCell modules have LEDs that provide traffic information and link status for the module. Table 1–3 describes the LEDs.

TABLE 1–3 PowerCell traffic and link LEDs.

Label	Color	Indicates…
X	Green	Transmit. This LED illuminates during runtime operation. When illuminated, this LED indicates that the PowerCell module is transmitting cells to the ATM network. If this LED goes dark, the PowerCell module is not sending traffic.
R	Green	Receive. This LED illuminates during runtime operation. When illuminated, this LED indicates that the PowerCell module is receiving cells from the ATM network. If this LED goes dark, the PowerCell module is not receiving traffic.
LNK L	Amber	Link status. This LED shows the link status for the ATM connection to the ATM switch. When this LED is glowing, the ATM link is “good.” The PowerHub system recognizes an unbroken physical connection to the ATM switch. The link-status LED goes dark if you remove the cable. If the cable is attached but the LED is still dark, the transmit and receive cables may be plugged into the wrong connectors, or a problem might exist in the ATM switch attached to the cable or in the cable itself.

1.2.5 ATM Engine LEDs

The PowerCell modules have LEDs for the ATM Engine in addition to the link status and traffic LEDs. (See Figure 1–1 on page 4.) The LEDs provide status information for the ATM Engine.

The PowerCell 700’s ATM Engine LEDs are located on the left side of the PowerCell 700. The module has two LEDs of each type listed in Table 1–4. The PowerCell 600’s ATM Engine LEDs are located to the right of the Packet Engine LEDs on the PowerHub 6000 Packet Engine.

Table 1–4 lists the ATM Engine LEDs.

TABLE 1–4 ATM Engine LEDs for PowerCell 700.

Label	Color	Indicates…
A	Red	Alarm. These LEDs indicate that the PowerCell module has crashed and remain lit until the PowerCell module is rebooted.
S	Green	The ATM CPUs are functioning normally. If both of these LEDs go out during normal operation, there might be a problem in the ATM Engine. (It is normal for either of the LEDs to be dark sometimes.)
B	Amber	The PowerCell module is booting. These LEDs flash when the module is booting, then go dark as soon as the module is finished booting.

1.3 SOFTWARE FEATURES

The PowerCell modules support the following software features:

- Multiple ATM protocols: LANE 1.0, Classical IP over ATM, RFC-1483 Encapsulation over PVC, and FORE IP.

> **NOTE**: The PowerCell 600 supports only LANE 1.0.

- Automatic segment-state detection.
- Local packet processing (on-board bridging, IP routing, and IPX routing).
- Configurable rate groups (PowerCell 700 only).

1.3.1 ATM Protocol Support

You can configure the segments on the PowerCell module individually to use one of the following ATM protocols:

- LANE (LAN Emulation) 1.0.
- RFC-1483 Encapsulation over PVC.
- Classical IP over ATM (RFC 1577).
- FORE IP.

> **NOTE**: The PowerCell 600 supports only LANE 1.0.

For each segment, you specify the ATM protocol and rate group to be used on the segment. The ATM protocol must be one of the protocols listed above. The *rate group* specifies how much traffic can be transmitted over a PowerCell segment. Rate groups can be defined for values from 0 Mb/s up to 155 Mb/s, the maximum bandwidth

supported by the PowerCell module. You specify the protocol and rate group for a segment on the PowerCell module using the **`segment-set`** command.
(See Section 2.10.1 on page 44.)

> **NOTE**: In addition to the information in this addendum, see the *ForeRunner ATM Switch Configuration Manual* for information about the ATM protocols supported by FORE Systems' ATM switches.

1.3.1.1 LANE 1.0

LANE (LAN Emulation) 1.0 overlays your Ethernet LANs on top of an ATM network. The PowerCell module can be used to overlay the Ethernet, Fast Ethernet, and FDDI networks managed by your PowerHub system onto ATM.

The ATM switch connected to the PowerHub system must support LANE 1.0. If the switch does not support LANE 1.0, consider using RFC-1483 Encapsulation instead. (See Section 1.3.1.2.) Note that all FORE Systems ATM switches support LANE 1.0.

You can configure the PowerCell module to connect to a maximum of one ELAN per segment on the PowerCell module (16 ELANs on the PowerCell 600 and 32 ELANs on the PowerCell 700).

The maximum packet size allowed by LANE 1.0 is 1518 bytes (the maximum Ethernet frame size).

See Chapter 3 for information about the PowerHub system's LANE 1.0 support and how to configure the PowerCell module for LANE 1.0.

1.3.1.2 RFC-1483 Encapsulation over PVC

RFC-1483 Encapsulation over PVC (hereafter called RFC-1483 Encapsulation) provides a mechanism for encapsulating bridged and routed packets. RFC-1483 Encapsulation is very useful in configurations where PowerHub systems connect LANs to an ATM backbone.

> **NOTE**: RFC-1483 Encapsulation is not supported on the PowerCell 600.

You can use LANE 1.0, Classical IP over ATM, or FORE IP to connect your Ethernet, Fast Ethernet, and FDDI LANs to ATM, but RFC-1483 Encapsulation is simpler to configure in networks that are fairly static. RFC-1483 Encapsulation relies on static connections (Permanent Virtual Circuits, or PVCs) that you define between a PowerCell segment and a port on the ATM switch. The PVCs are easy to configure and manage.

Using RFC-1483 Encapsulation, you can configure up to 32 segments on the PowerCell 700. Each segment can have two unidirectional PVCs, one "in" and one "out."

See Chapter 4 for information about the PowerHub system's RFC-1483 Encapsulation support and how to configure the PowerCell module for RFC-1483 Encapsulation.

1.3.1.3 Classical IP over ATM (RFC 1577)

Classical IP over ATM is an ATM standard that lets you route IP traffic between your Ethernet and FDDI LANs and the ATM network. Classical IP over ATM is described in RFC 1577.

> **NOTE**: CLIP is not supported on the PowerCell 600.

Although LANE 1.0 also allows you to route using IP, Classical IP over ATM has a larger maximum MTU size—65535 bytes. The default is 9188 bytes. (The SNAP header adds an additional 8 bytes.)

> **NOTE**: Software version 7-2.6.4.0 supports forwarding only of frames up to 1518 bytes long.

Classical IP does not provide broadcast/multicast services. If you need broadcast/multicast services and also need the long packet size, use FORE IP. (See Section 1.3.1.4.)

RFC 1577 does not provide for broadcast/multicast packets. However, the FORE Systems implementation lets you add broadcast/multicast capability by adding the IP nodes to the PowerCell module as neighbors. In this context, a neighbor is an IP node in the same LIS (Logical IP Subnet) as the PowerCell module.

You can configure the PowerCell 700 with up to 32 CLIP interfaces (one IP address per segment on the module). You cannot have multiple subnets on the same interface. In addition, the subnet cannot span multiple segments.

See Chapter 5 for information about the PowerHub system's CLIP support and how to configure the PowerCell module for CLIP.

1.3.1.4 FORE IP

FORE IP is a FORE Systems proprietary protocol that enables you to route IP traffic between your Ethernet, Fast Ethernet, and FDDI LANs and an ATM network. Unlike Classical IP over ATM, which does not yet have a standard mechanism for broadcast or multicast packets, FORE IP fully supports broadcast and multicast services.

> **NOTE**: FORE IP is not supported on the PowerCell 600.

> **NOTE**: Software version 7-2.6.4.0 does not contain multicast support.

FORE IP allows packet sizes up to 65535 bytes. The default is 9188 bytes. (The SNAP header adds an additional 8 bytes.)

> **NOTE**: Software version 7-2.6.4.0 supports forwarding only of frames up to 1518 bytes long.

FORE IP can be used with all FORE Systems ATM hardware. However, because FORE IP is not based on an ATM Forum standard, you might not be able to use FORE IP with other vendors' ATM hardware. If you want to use FORE IP with another vendor's hardware, check with your vendor about compatibility or contact FORE Systems TAC.

You can configure up 32 segments for FORE IP on the PowerCell 700.

See Chapter 6 for information about the PowerHub system's FORE IP support and how to configure the PowerCell module for FORE IP.

1.3.2 Configurable Rate Groups (PowerCell 700 only)

Each model of PowerCell module provides up to 155000 Kb/s (155 Mb/s) of transmit bandwidth. The software is configured by default to share the 155000 Kb/s across all the logical segments on the PowerCell module. The PowerCell 700 lets you control the transmit bandwidth on the module.[2]

> **NOTE**: One Mb/s is equivalent to exactly 1000 Kb/s, not 1024 Kb/s.

You can define up to 16 separate rate groups on the PowerCell 700.

Depending upon your network configuration, you might want to dedicate portions of the 155000 Kb/s to specific segments. You can dedicate a portion of the PowerCell 700's transmit bandwidth to a set of segments by assigning a rate group to that set of segments. A *rate group* specifies the maximum amount of traffic that can be transmitted over the ATM segments to which the rate group is assigned.

You can use rate groups to do the following:

- Guarantee a specific bandwidth on a set of PowerCell segments. By configuring a rate group and applying the group to a set of PowerCell segments, you can guarantee the availability of that bandwidth on the segment, regardless of how much bandwidth is in use by other segments. Note that the specified bandwidth is shared among the segments in the rate group.
- Limit the transmit bandwidth on a set of PowerCell segments to a specific maximum value. If the ATM devices in the segments cannot accommodate 155000 Kb/s, you can use a rate group to limit the bandwidth on the segments attached to that ELAN.

2. The PowerHub manuals usually talk about bit rates in terms of Mb/s; however, you can define rate groups in terms of Kb/s, so this manual discusses rate groups in terms of Kb/s instead of Mb/s.

Figure 1–6 shows how rate groups can be used to allocate the PowerCell's transmit bandwidth to serve devices that have different bandwidth needs.

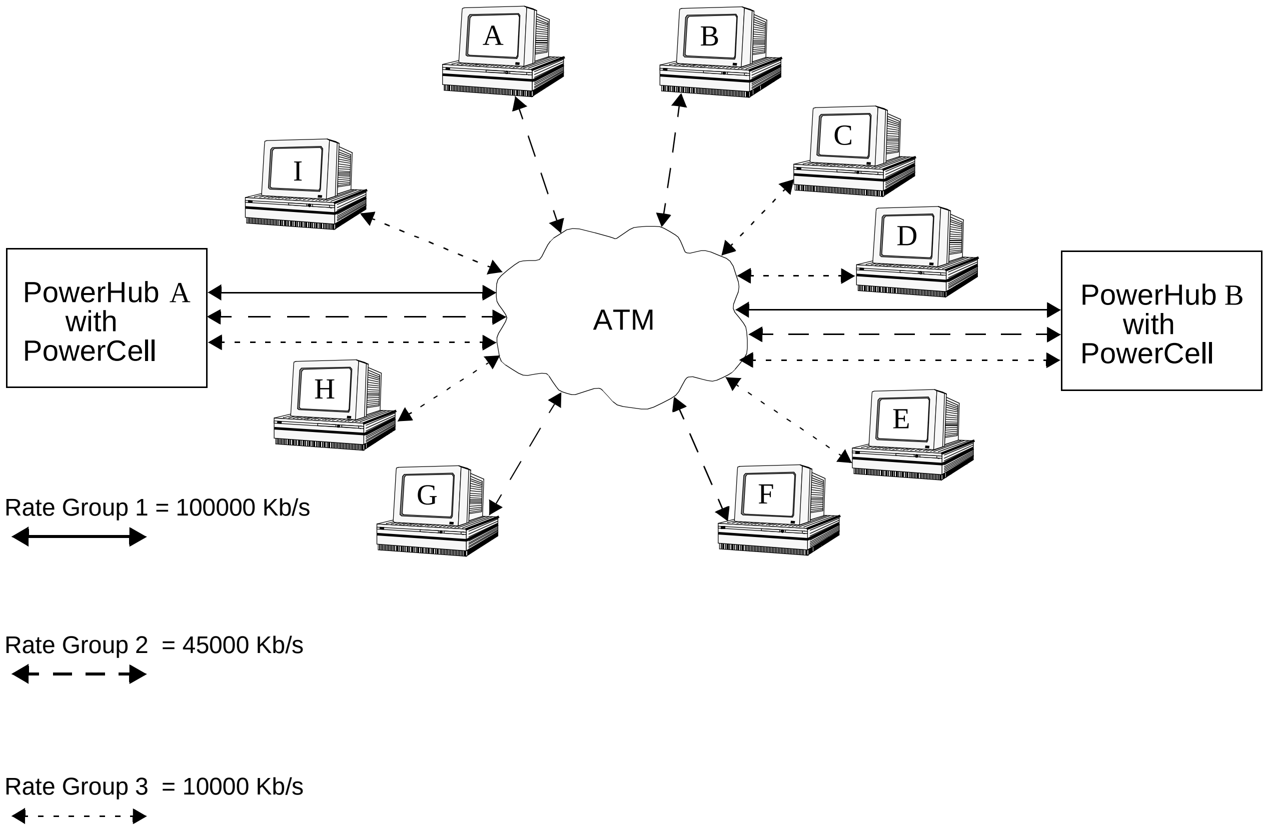


FIGURE 1–6 Rate groups.

In Figure 1–6, two PowerHub systems containing PowerCell 700 Modules provide connections to different parts of an ATM network. Rate groups 1, 2, and 3 have been defined on both systems:

- Rate group 1 allows traffic at 100000 Kb/s. In Figure 1–6, rate group 1 is being used for the ATM connections between the PowerHub systems through the ATM network.
- Rate group 2 allows traffic at 45000 Kb/s. In Figure 1–6, rate group 2 is being used for the ATM connections between the PowerHub systems and workstations A, B, F, and G.
- Rate group 3 allows traffic at 10000 Kb/s. In Figure 1–6, rate group 3 is being used for the ATM connections to workstations C, D, E, H, and I.

Note that the rate group guarantees bandwidth from the PowerCell 700 to the ATM switch, but not from the ATM switch to the PowerCell or to other portions of the ATM network. See your ATM switch's documentation for information about available bandwidth and how it is allocated across the switch's ports.

All segments that use a common rate group share the bandwidth of that rate group. For example, if you assign rate group 1 with its default value of 155000 Kb/s to all the ATM segments on the PowerCell 700, all the segments share the same 155000 Kb/s.

You can define up to 16 different rate groups per PowerCell module. The sum of the bandwidths of all the defined rate groups must be less than or equal to 155000 Kb/s (for OC-3 interfaces). More than one segment can use the same rate group, but a segment can use only a single rate group. All PowerCell segments are capable of receiving traffic at the maximum bit rate supported by the connection type. For example, the PowerCell module can receive ATM traffic at up to 155000 Kb/s on an OC-3 connector or a UTP connector.

All ATM signalling and ILMI traffic is transmitted on rate group 1, which is the default rate group for all segments. Unless you want to eliminate ATM signalling and ILMI, do not configure rate group 1 to use 0 Kb/s and make sure at least one ATM segment on each PowerCell module uses rate group 1.

Figure 1–7 shows an example of how the three rate groups used in Figure 1–6 could be assigned to segments on the PowerCell 700.

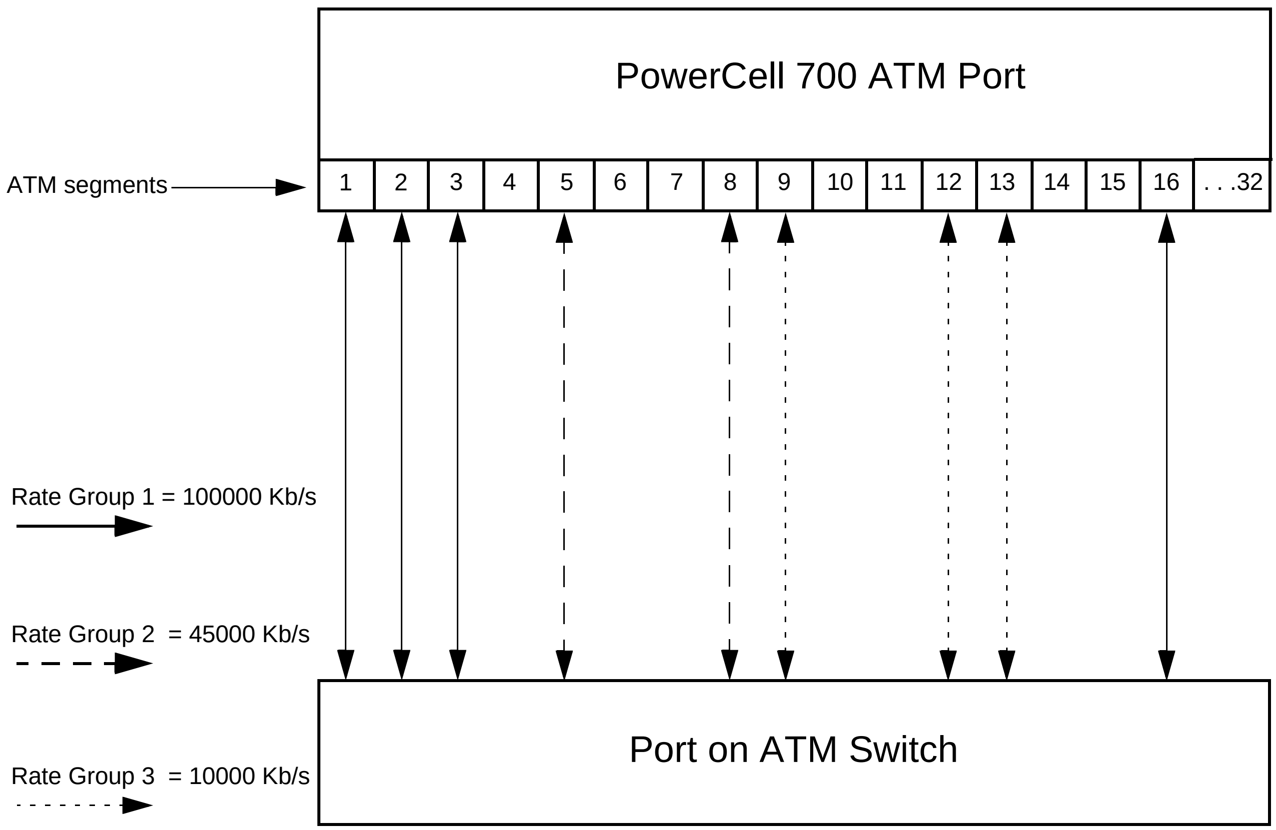


FIGURE 1–7 Rate groups and PowerCell segments.

In this example, nine of the 32 logical segments on a PowerCell 700 have been configured for use with the attached ATM switch (a device somewhere in the ATM cloud shown in Figure 1–6). An ATM protocol and a rate group have been added to these segments using commands in the PowerHub **atm** subsystem.

Segments 1, 2, 3 and 16 all use rate group 1. The PowerCell 700 is permitted to send traffic at up to 100000 Kb/s on these segments. Moreover, these segments are guaranteed 100000 Kb/s collectively even when the remaining segments are sending at their maximum rates.

Segments 5 and 8 use rate group 2. Notice that rate group 2 allows up to 45000 Kb/s. This rate group is appropriate for a network containing interfaces that can accept traffic no faster than 45000 Kb/s.

Segments 9, 12, and 13 use rate group 3, configured to allow up to 10000 Kb/s. In this example, most of the traffic on these segments goes to and from 10000 Kb/s Ethernet segments in the Ethernet LAN attached to the PowerHub system. Therefore, these ATM segments do not require as much bandwidth as the other ATM segments. The remaining 10000 Kb/s bandwidth available on the PowerCell module is adequate to serve the segments that use rate group 3.

See Section A.4.2.1 on page 123 for information about how to define rate groups and apply them to PowerCell segments.

1.3.3 Local Packet Processing

The PowerCell modules can perform some packet processing independently of the Packet Engine. The PowerCell modules enhance the overall throughput of the system by locally bridging or forwarding traffic that normally travels to the Packet Engine for processing.

The PowerCell modules provide the following local packet-processing features:

- Local forwarding.
- Local bridge filtering.

The local packet-processing features enhance overall performance in the following ways:

- The amount of packet traffic on the Packet Engine is reduced.
- The amount of time the Packet Engine spends processing packets received for forwarding is reduced.

You can use the **`ginim stats`** command to display local packet-processing statistics for a PowerCell module. (See Section B.3 on page 164.)

1.3.3.1 Local Forwarding

The PowerCell module maintains copies of the Packet Engine’s bridge, IP, and IPX caches to perform local forwarding. When the PowerCell module receives a packet destined for another segment, the PowerCell module checks for an entry in the appropriate cache:

- If an entry is found, the PowerCell module alters the packet as necessary for bridging or routing, then tags the packet with its destination segment. The packet’s destination determines what happens to the packet next:
  - If the packet is destined for another segment in the same PowerCell module, the packet goes directly to the destination segment and is not sent to the Packet Engine.
  - If the packet is destined for a segment on another module, the packet is processed by the PowerCell module, then sent to the Packet Engine. The Packet Engine then sends the packet to the destination segment. Because the packet is processed for forwarding by the PowerCell module, the Packet Engine does not need to process the packet for forwarding. The Packet Engine can send it directly to the module containing the destination segment.
- If an entry for bridging or routing the packet is not found in the appropriate cache on the PowerCell module, the PowerCell module sends the packet to the Packet Engine for forwarding.

In software version 7-2.6.4.0, local forwarding is supported by FORE IP and by LANE 1.0, but not by CLIP. The above process will work between two or more FORE IP segments, between two or more LANE 1.0 segments, and across FORE IP and LANE 1.0 segments.

With CLIP segments, the PowerCell module alters the packet as necessary for bridging or routing and tags the packet with its destination segment, but will always send the packet to the Packet Engine, even if the packet is destined for another segment in the same PowerCell module. The Packet Engine then forwards the packet to the destination segment.

1.3.3.2 Local Bridge Filtering

In some network configurations, it is possible for the PowerCell module to receive a packet whose destination address is for a station attached to the same segment as the one on which the PowerCell module received the packet. When this occurs, the PowerCell module locally “filters” the packet, dropping it rather than needlessly forwarding it to the Packet Engine.

1.3.3.3 PowerHub 7000 Example

Figure 1–8 shows an example of how traffic flows in a PowerHub 7000 that contains intelligent NIMs.

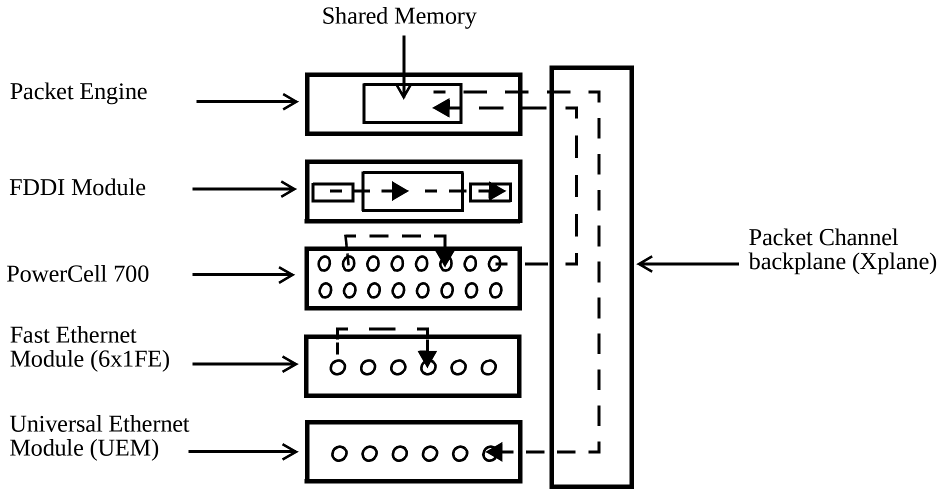


FIGURE 1–8 Local processing on Intelligent NIMs.

As depicted in Figure 1–8, traffic received on one segment on an intelligent NIM that is bound for another segment on the same NIM is forwarded directly to that segment, bypassing the Packet Engine. Packet processing takes place locally, on the NIM itself. Even packets destined to other NIMs have some pre-processing done to them in order for the packets to be forwarded more quickly by the Packet Engine. Note that this type of processing applies only to bridge, IP, and IPX traffic. On the PowerCell 700, IP traffic includes FORE IP traffic and Classical IP (RFC 1577) traffic as well as IP traffic in LANE 1.0. However, in software version 7-2.6.4.0, local forwarding for CLIP is not supported.

1.3.4 Automatic Segment-State Detection

The *automatic segment-state detection feature* detects the physical and logical states of the PowerCell ATM segments.

- The physical state refers to whether the link between the PowerCell port and the ATM switch is good. If the link goes down, the PowerHub software disables the corresponding ATM segments on the PowerCell module.
- The logical state refers to whether the ATM interfaces configured on the individual PowerCell segments are active. For example, if an ATM segment has been configured for LANE 1.0, the automatic segment-state detection feature detects whether the ELAN configured on the segment is active. If the ELAN is not active, the segment is reported to be down, even if the physical link to the ATM switch is good.

When the automatic segment-state detection feature detects a state change, it automatically enables or disables bridging and routing on the changed segment(s) and marks the change in table displays.

The automatic segment-state detection feature prevents the software from wasting packet-processing resources with unnecessary attempts to forward traffic to the down segments. Automatic segment-state detection also allows the Spanning-Tree algorithm and the routing algorithms to quickly reconfigure around down segments.

To display the state of a segment or to disable automatic segment-state detection, use the **`mgmt autoportstate`** command. (See Section 2.12 on page 49.) You also can display port- and segment-state information using the **`bridge state`** command. (See Chapter 2 in the *PowerHub Software Manual*.)

2 Installation

This chapter explains how to configure your FORE ATM switch and your PowerHub system for ATM switching over the PowerHub system. Depending upon whether the chassis already contains the PowerCell module, the software installed on the PowerHub system, and your configuration needs, you might not need to perform all of the tasks described in this chapter.

This chapter contains the following sections:

2.1 SAFETY AND HANDLING PRECAUTIONS

Use care and common sense when handling PowerHub hardware. Improper handling of PowerHub hardware can result in damage to the components or injury to yourself.

To avoid personal injury:

- Do not immerse components in water or any other liquid.
- Do not stand on a wet surface while inserting or removing PowerHub modules.
- Always cover unused slots or bays with the supplied cover plates. Never place tools, your hand, or any other body part inside empty power module bays or module slots.

2.1.1 Electrostatic Discharge

All electronic components, including PowerHub components, can be damaged by improper handling. One of the most common, although unintentional, types of mishandling is *electrostatic discharge* (*ESD*).

Electrostatic discharge can occur when you and the equipment you are handling are at different voltage potentials. When you come into contact with the equipment, the difference in your potentials causes energy to be passed from you to the component, delivering a shock to the component.

The human body is a good conductor of electricity and can deliver shocks containing thousands of volts. In fact, most people perceive a static shock only when the voltage of the shock is at least 6,000 volts. However, many electronic components can be damaged by shocks as low as 2,000 volts!

2.1.2 Guarding Against Damage

To guard against damaging PowerHub modules, always take the following precautions when handling the modules:

- Wear an anti-static wrist guard. Make sure the wrist guard directly touches the skin. To guard against ground faults, use a wrist guard that has a 1M¾ (one megohm) resistor.
- Always store modules in their original packaging.
- Never operate the PowerHub 7000 or 6000 with exposed power module bays or NIM slots. Operating the unit without cover plates installed over unused bays or slots voids the warranty.
- Handle the modules only by their edges. Never directly touch components on the modules.

- Never remove a module from its protective packaging or from a chassis until you, the chassis, and the work surface are properly grounded. If the work surface is metallic, you can ground it by attaching a wire from the surface to the electric ground in the building. If the work surface is not metallic, use a ground-conductive rubber mat as your work surface.

> **NOTE**: Low humidity levels can increase the danger of electrostatic discharge. Use extra caution if the PowerHub system is in a low-humidity environment.

- After you, the chassis, and any loose components are grounded, touch the chassis or work surface containing the component, ***before*** touching the component itself. In this way, you neutralize any charge before it can damage the component. Note that you and the chassis or other surface ***must*** be grounded for this to be effective.

2.1.3 Connector Pins

Use care when handling modules that have connector pins. Modules such as the Packet Channel backplane and the power backplane contain many small pins that plug into headers in other modules. These pins can be bent if you accidentally drop or slide the modules, or if you mis-align or use excessive force to seat the modules' pins in a header.

Pin damage caused by mishandling is not covered by your warranty. If you do accidentally bend a pin, you sometimes can prevent the pin from becoming broken by bending it back into position before attempting to seat the module.

2.1.4 Thumbscrews

Always use the appropriate screwdriver to tighten thumbscrews on the modules. If you do not use a screwdriver to tighten the thumbscrews, the modules can come loose through ordinary vibration, such as installing cables or moving adjacent modules and cover plates. Depending upon the module type, you need either a regular flat-head screwdriver or a #2 Phillips-head screwdriver to tighten the thumbscrews.

- The thumbscrews on the PowerHub 7000 Packet Engine and NIMs require a regular flat-head screwdriver and the power modules require a #2 Phillips-head screwdriver.

- The thumbscrews on the PowerHub 6000 Packet Engine, UMM, NIMs, and power supplies require a #2 Phillips-head screwdriver.

2.1.5 Care of Fiber-Optic Systems and Cables

Always use care when connecting fiber-optic cables. Although they look like standard copper cables, they are delicate. In addition to the general precautions discussed above, fiber-optic systems require some additional precautions:

- Keep the factory-supplied dust covers on all unused fiber connectors and PowerHub optical components.
- Avoid repeated sharp bending of fiber-optic cable because it can cause micro-cracking of the glass fiber. Be particularly careful of the open ends of the uncovered connectors.
- Make sure that the connector surfaces are not dragged along the floor or dropped onto hard or abrasive surfaces.

2.2 ENVIRONMENTAL REQUIREMENTS

The PowerHub system is designed to operate within ambient temperatures of 0° to 40° C (32° to 104° F) and at 10% to 90% relative humidity, non-condensing. The corresponding storage requirements are –20° to 55° C (–4° to 131° F) and 90 percent maximum relative humidity, non-condensing. The floppy diskettes used with the PowerHub 7000 require an ambient temperature of at least 10° C (50° F).

To ensure adequate air flow for cooling, the PowerHub system requires at least a 3” clearance on each side and in front. Operating the hub without adequate clearance for cooling voids the warranty.

2.3 INSTALLING THE POWERCELL MODULE IN THE CHASSIS

If you ordered your PowerHub system with the PowerCell module, the PowerCell module is already installed. You do not need to install it. Stop reading this section and see one of the following manuals for setup instructions for your PowerHub system:

PowerHub 7000	Chapter 6 in the *PowerHub 7000 Installation and Configuration Manual.*
PowerHub 6000	Chapter 4 in the *PowerHub 6000 Installation and Configuration Manual.*

When you are finished, go to Section 2.7 on page 36.

If you are adding the PowerCell module to a previously installed system, use one of the following procedures to install the PowerCell module into your system.

2.3.1 PowerCell 700

For this procedure, you need:

- A medium-blade, flat-head screwdriver.
- An ESD wrist-strap.
- A grounded work surface, such as a grounded metal table or a table covered with a grounded, rubberized mat. (See Section 2.1.2 on page 20.)

> **CAUTION**: Static electricity can damage the electronic components of the PowerCell 700. Make sure you take appropriate precautions as described in Section 2.1. Also, do not touch the electronic components of the PowerCell 700 directly.

To install the PowerCell 700:

(1) If the chassis slot in which you plan to install the PowerCell 700 is not covered by a cover plate, go to the next step. If the slot is covered by a cover plate, use the #1 Phillips-head screwdriver to loosen the screws on the ends of the plate. Continue loosening them until they spring free from the chassis. When you have removed the coverplate, go to Step 3.

(2) If the slot in which you plan to install the PowerCell 700 contains another NIM, you must remove the NIM. Use the instructions in Chapter 6 in the *PowerHub 7000 Installation and Configuration Manual*. (If the PowerHub system is powered on, remember to use the **`mgmt card-swap`** *`<slot>`* **`out`** command to swap out the NIM you are removing; otherwise, the PowerHub system can crash.)

(3) Holding the PowerCell 700 by its plated edges, align the rear corners of the module in the groove on each side of the empty slot. The groove is just below the screw holes for the thumbscrews, as shown in Figure 2–1. When the PowerCell 700 is in this position, the ATM port(s) are facing outward, away from the chassis.

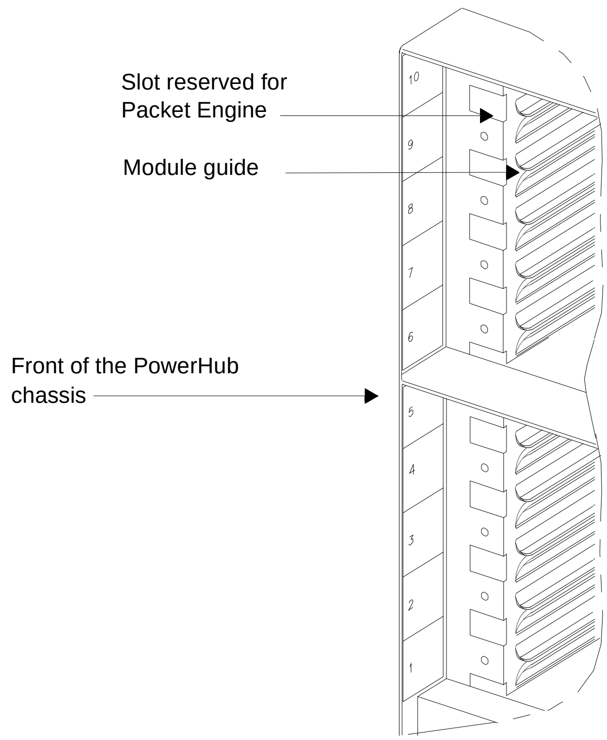


FIGURE 2–1 Module guides in chassis slots.

Make sure you do not touch the components on the PowerCell 700. Also remember that the Packet Engine always goes in the top slot. You cannot install the PowerCell 700 or any other NIM in the top slot.

(4) Slide the PowerCell 700 at least two-thirds of the way into the slot. Do not force the module. If it does not slide easily, remove it and try again.

(5) Grasp the ejector handles on each side of the PowerCell 700, making sure the handles point back toward you, and push the module the rest of the way into the slot. When the module is in place, the front panel is flush with the other modules or cover plates in the chassis.

(6) Secure the PowerCell 700 into place by pressing the ejector handles against the front panel.

> **IMPORTANT**: Each module has an activation switch behind the ejector handle on the left side of the module. For the module to operate, the ejector handle must be pressing on the activation switch. When you install the module, make sure you press the ejector handles all the way into place.

(7) Use the flat-head screwdriver to tighten the thumbscrews.

> **NOTE**: You do not need to reboot the system if you removed a PowerCell module from the same NIM slot, in Step 2. Instead, you can issue the **`mgmt card-swap`** *`<slot>`* **`in`** command after you install the module.

(8) Reboot the PowerHub system to activate the PowerCell module.

2.3.2 PowerCell 600

For this procedure, you need the following:

- A regular flat-head screwdriver.
- A #1 Phillips-head screwdriver.
- A #2 Phillips-head screwdriver (if the Packet Engine contains the Packet Channel backplane).
- An ESD wrist-strap.
- A grounded work surface, such as a grounded metal table or a table covered with a grounded, rubberized mat. (See Section 2.1.2 on page 20.) Figure 2–2 shows where the PowerCell 600 is installed on the Packet Engine. Refer to this figure as you perform the following procedure.

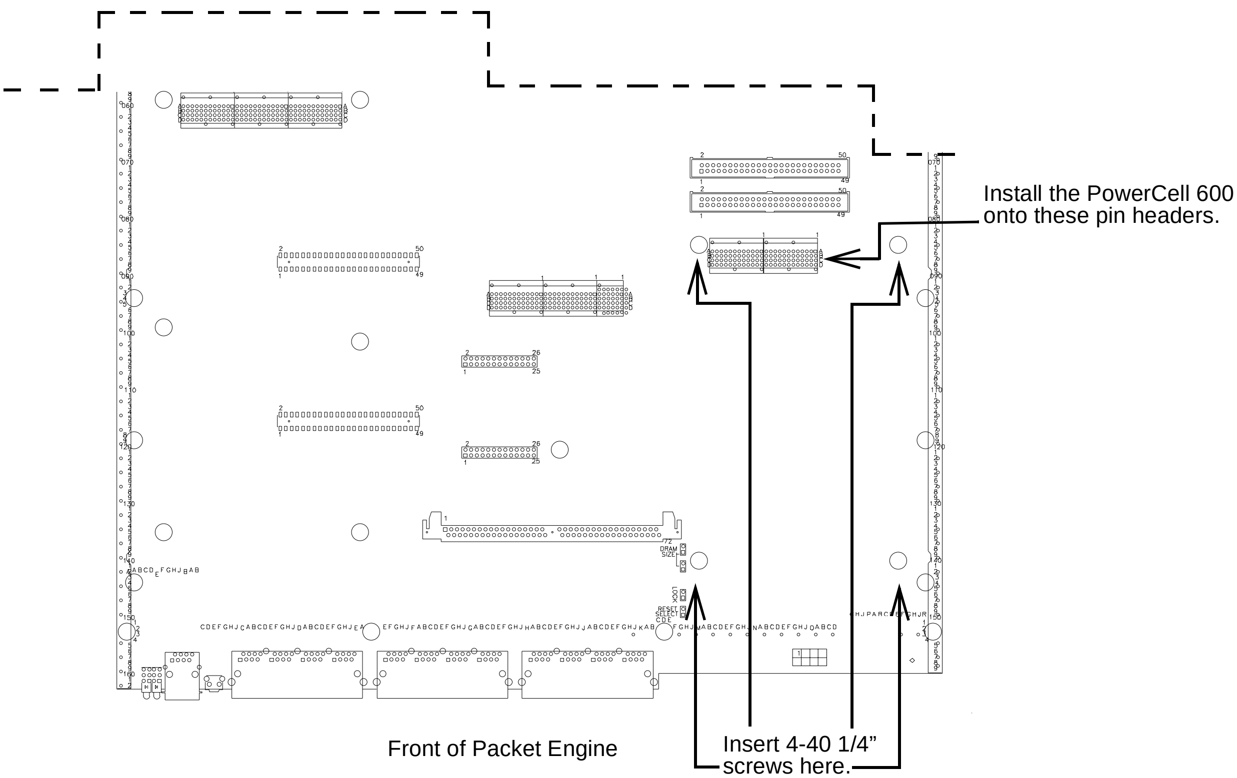


FIGURE 2–2 Where the PowerCell 600 is installed.

To install the PowerCell 600:

(1) If the top slot in the chassis contains a NIM, remove it using the procedure in Section 5.11.2 of the *PowerHub 6000 Installation and Configuration Manual.*

> **IMPORTANT**: You must remove the modules from the top down. That is, remove the module in the top slot, then remove the module in the middle slot, before attempting to remove the Packet Engine. Do not attempt to remove a module until all modules above it have been removed.

(2) Remove the NIM or UMM from the middle slot in the chassis, as applicable:

- To remove a NIM, use the procedure in Section 5.11.2 of the *PowerHub 6000 Installation and Configuration Manual.*
- To remove the UMM, use the procedure in Section 5.8.2 of the *PowerHub 6000 Installation and Configuration Manual*.

(3) Remove the Packet Engine. (See Section 5.2.2 of the *PowerHub 6000 Installation and Configuration Manual*.)

(4) Holding the PowerCell 600 by its edges, turn the module so that it is component-side down, with the ATM port connector facing the front of the chassis.

(5) Tilt the ATM port connector down slightly, then insert the connector into the corresponding opening in the Packet Engine front panel.

(6) Carefully align the pin header on the PowerCell 600 over the two corresponding pin sockets on the Packet Engine, as shown in Figure 2–2. The header is properly aligned when the header edges are flush with the pin socket.

(7) Gently press down on the PowerCell 600 where the header is aligned over the pins on the Packet Engine, until the header is completely in the pin socket.

(8) Use the #1 Phillips-head screwdriver to insert the four 4-40 1/4” pan-head screws into the holes that align over the corresponding standoffs on the Packet Engine. The screw holes are on the top of the PowerCell 600 and screw into the standoffs on the Packet Engine.

(9) Use the #1 Phillips-head screwdriver to insert the two 4-40 1/4” pan-head screws on both sides of the PowerCell 600’s ATM port connector, on the Packet Engine’s front panel.

(10) Reinstall the Packet Engine. (See Section 5.2.1 of the *PowerHub 6000 Installation and Configuration Manual*.)

(11) Reinstall the coverplates, UMM, or NIMs you removed from the middle and top slots. (See Section 5.11.1 for instructions on installing a NIM or Section 5.8.1 on installing the UMM. Both sections are in the *PowerHub 6000 Installation and Configuration Manual*.) Remember to install the middle module or coverplate first, then the top module or coverplate.

> **NOTE**: Make sure you install the appropriate cover plates over all unused slots, EMA positions, and power supply bays.

2.4 INSTALLING OR REMOVING AN AMA (POWERCELL 700 ONLY)

If your PowerCell 700 contains only the primary PHY but you want to use a backup PHY, you can install an AMA (ATM Media Adapter) in the `BACKUP` slot in the PowerCell 700.

The procedures in this section refer to sections in the *PowerHub 7000 Installation and Configuration Manual*. You might want to locate your copy of this manual now, before beginning either of the following procedures.

2.4.1 Installing an AMA

Use the following procedure to install an AMA (ATM Media Adapter) in the PowerCell 700.

> **CAUTION**: Static electricity can damage the electronic components of the PowerHub 7000. Make sure you take appropriate precautions as described in Section 2.1 on page 20. Also, do not touch the electronic components of the PowerHub modules directly.

For this procedure, you need:

- A PowerCell 700 Module.
- An AMA.
- Three 4-40 1/4” pan-head screws.
- A #1 Phillips-head screwdriver.
- An ESD wrist-strap.
- A grounded work surface, such as a grounded metal table or a table covered with a grounded, rubberized mat. (See Section 2.1.2 on page 20.)

> **CAUTION**: Static electricity can damage the electronic components of the PowerCell 700. Make sure you take appropriate precautions as described in Section 2.1. Also, do not touch the electronic components of the PowerCell 700 directly.

Figure 2–3 shows how an AMA is attached to the PowerCell 700 Module. You might want to refer to this figure as you perform the following procedure.

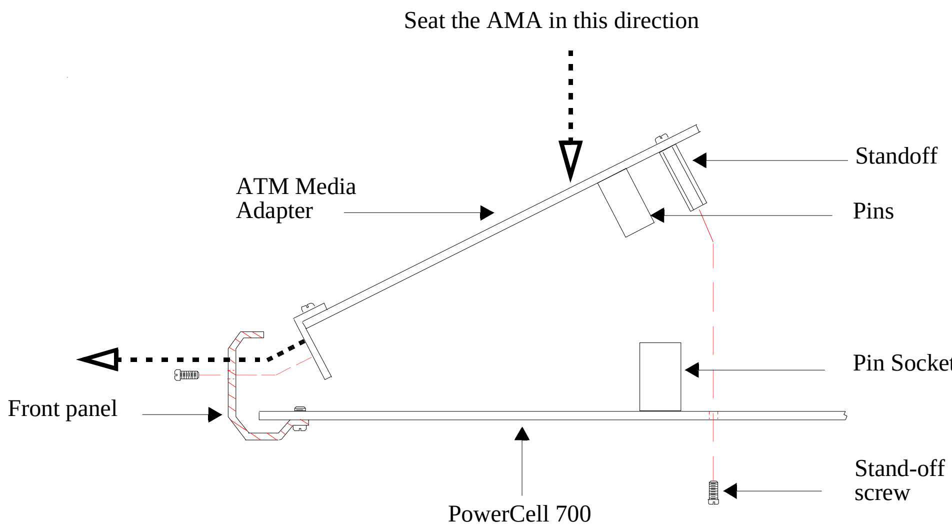


FIGURE 2–3 How an ATM Media Adapter is mounted on the PowerCell 700 (side view).

To install the AMA:

(1) If you have not already done so, use the appropriate procedure in Chapter 6 of the *PowerHub 7000 Installation and Configuration Manual* to remove the PowerCell 700 from the PowerHub chassis.

> **CAUTION:** Never attempt to add, remove, or modify components on a Packet Engine or NIM when the module is still in the chassis. Components can break or become damaged through electrostatic discharge, or the module itself can crack as a result of improper handling.

(2) Grab the rear of the AMA. To avoid bending the pins or poking holes in your fingers, make sure not to grab the pin connections.

(3) Gently insert the ATM port connector on the front of the AMA through the appropriate hole on the PowerCell 700’s front panel. Ensure that the ATM port connector is fully forward by pushing on it until it is firmly in place.

(4) Align the AMA pins directly over the socket on the PowerCell 700.

(5) When the pins are aligned over the socket, firmly press the pins down into the socket. Make sure the pins go all the way into the socket.

(6) To secure the AMA to the PowerCell 700, use the #1 Phillips-head screwdriver to insert a 4-40 1/4” pan-head screw into the screw hole on the underside of the PowerCell 700. Tighten the screw.

(7) Using the #1 Phillips-head screwdriver, insert two 4-40 1/4” pan-head screws into the PowerCell 700’s front panel.

(8) If you need to install another AMA, repeat Steps 2 through 8; otherwise, use the procedure in Section 2.3.1 on page 23 to reinstall the PowerCell 700.

2.4.2 Removing an AMA

This procedure describes how to remove an AMA (ATM Media Adapter) from the PowerCell 700. Remove the AMA only if you want to change the PHY type (and therefore need to install a different AMA) or if the AMA is defective.

> **CAUTION**: Static electricity can damage the electronic components of the PowerHub 7000. Make sure you take appropriate precautions as described in Section 2.1 on page 20. Also, do not touch the electronic components of the PowerHub modules directly.

For this procedure, you need:

- A PowerCell 700 Module.
- A #1 Phillips-head screwdriver.
- If you do not plan to replace the removed AMA, install the appropriate cover plate (part number 171-1667-0001).
- An ESD wrist-strap.
- A grounded work surface, such as a grounded metal table or a table covered with a grounded, rubberized mat. (See Section 2.1.2 on page 20.)

> **CAUTION**: Static electricity can damage the electronic components of the PowerCell 700. Make sure you take appropriate precautions as described in Section 2.1. Also, do not touch the electronic components of the PowerCell 700 directly.

Figure 2–3 shows how to remove an AMA from the PowerCell 700. You might want to refer to this figure as you perform the following procedure.

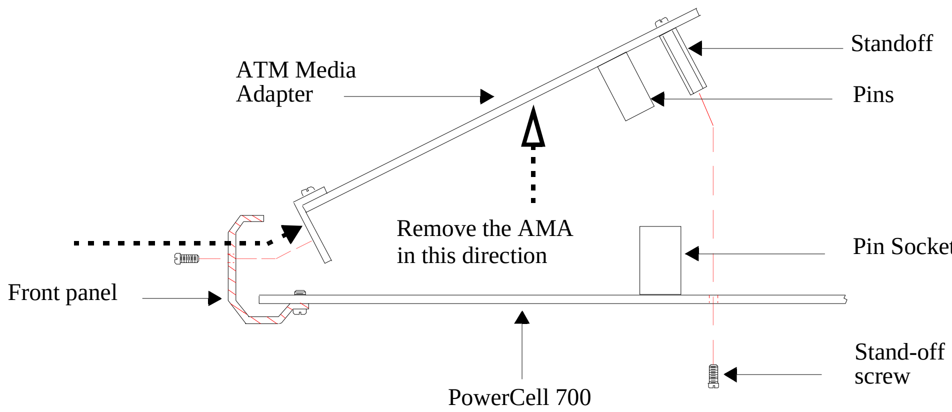


FIGURE 2–4 How an ATM Media Adapter is removed from the PowerCell 700 (side view).

To remove an AMA from the PowerCell 700:

(1) Use the appropriate procedure in Chapter 6 of the *PowerHub 7000 Installation and Configuration Manual* to remove the PowerCell 700 from the chassis.

> **CAUTION:** Never attempt to add, remove, or modify components on a Packet Engine or NIM when the module is still in the chassis. Components can break or become damaged through electrostatic discharge, or the module itself can crack as a result of improper handling.

(2) Use the #1 Phillips-head screwdriver to remove the 4-40 3/8” pan-head screw (standoff screw) that secures the AMA to the PowerCell 700. This screw is located on the underside of the PowerCell 700. Do not remove the standoff from the AMA itself.

(3) Use the #1 Phillips-head screwdriver to remove the two 4-40 3/8” pan-head screws that secure the AMA to the front panel of the PowerCell 700.

(4) Grab the rear of the AMA. To avoid bending the pins or poking holes in your fingers, make sure not to grab the pin connections.

(5) Gently pull up on the rear of the AMA to loosen the pins from the socket on the PowerCell 700. If the pins do not come loose, gently rock the rear of the AMA from side to side while pulling up. Stop pulling as soon as the pins come loose! If you continue to pull, you might crack the AMA.

(6) When the AMA pins are free from the socket on the PowerCell 700, gently pull the AMA straight back out of the PowerCell 700 front panel. If the AMA gets caught, gently jiggle it free. Do not force the AMA to come free; you might break components.

(7) When the AMA is completely free of the PowerCell 700, either place the AMA in its protective container for storage or, if you plan to install it in another slot on the PowerCell 700 or in another PowerCell 700, place it on a grounded table.

(8) If you do not plan to immediately replace the AMA with another one, use the screwdriver to install a cover plate over the unused AMA position.

(9) If you need to remove another AMA, repeat Steps 2 through 8; otherwise, use the procedure in Section 2.3.1 to reinstall the PowerCell 700.

2.5 POWERING ON THE HUB AND BOOTING THE SOFTWARE

When you power on the hub, the software is booted. To power on the hub, use the appropriate procedure below.

2.5.1 PowerHub 7000

> **NOTE**: Make sure the PowerHub chassis contains enough power modules for the PowerCell 700:
>
> - A PowerCell 700 module containing one AMA (PHY) requires 7.5 +5V Amps.
> - A PowerCell 700 module containing two AMAs (PHYs) requires 8.0 +5V Amps.
>
> To determine whether the chassis contains enough power modules, see Section "Power Requirements" in Chapter 6 of the *PowerHub 7000 Installation and Configuration Manual*.

To power on the PowerHub 7000 and boot the software:

(1) Make sure the chassis contains at least the minimum number of power modules required for your configuration. If you are not sure, see Chapter 6 in the *PowerHub 7000 Installation and Configuration Manual*. Also, make sure a power module is installed in the primary power module bay. In chassis with two power module bays, the primary bay is the left bay. In chassis with more than two bays, the primary bay is the upper-left bay.

(2) Make sure all unused slots and bays in the chassis are covered with their cover plates. Operating the hub without cover plates installed over unused bays or slots is unsafe, potentially damaging, and can void the warranty.

(3) Plug the power module cables into the power modules, then into a grounded circuit(s) capable of supplying the required amount of AC or DC current. (See Chapter 6 in the *PowerHub 7000 Installation and Configuration Manual*.)

(4) Switch on all the power modules at the same time (or at least the minimum number of modules required for your configuration). If you do not switch on at least the minimum

number of power modules required, the power modules you do switch on will become overloaded and shut down.

To simplify this step, you can plug all the power modules into a power strip or into the same circuit(s), then apply power to the strip or circuit(s) to simultaneously apply power to all the modules.

> **NOTE**: If a power module becomes overloaded and shuts down, switch all the power modules off to reset the ones that are overloaded, then simultaneously switch all the power modules on again.

If the PowerHub 7000 does not boot when you apply power, check the LEDs on the power modules and Packet Engine. If no LEDs are glowing, you might have an overload somewhere in your power circuit or the hub might not contain enough power modules. First make sure you have enough power modules for your configuration, then check your power circuit.[1] For information on power requirements for other PowerHub modules, see Chapter 6 in the *PowerHub 7000 Installation and Configuration Manual.*

When the software is booted, the runtime command prompt is displayed:

```
1:PowerHub:main#
```

However, if you abort the boot process, the prompt for the Packet Engine boot PROM is displayed:

```
<PROM-7pe>
```

To resume the boot process, issue the following command at the `<PROM-7pe>` prompt:

`b [fd|net|fm]`

where:

`fd`	Boots from the floppy diskette.
`net`	Boots from the network. (You must configure the hub for netbooting if you specify this option. See Section 2.14 on page 51.)
`fm`	Boots from the Flash Memory Module.

If you do not specify a boot source, the boot order configured in NVRAM is used. If you have not configured a boot order, the floppy drive (**`fd`**) is used.

1. A PowerCell 700 with one AMA (PHY) requires 7.5 +5V Amps and a PowerCell 700 with two AMAs (PHYs) requires 8.0 +5V Amps.

2.5.2 PowerHub 6000

To power on the PowerHub 6000 and boot the software:

(1) Make sure the chassis contains at least the primary power supply. The primary power supply goes in the power supply bay labeled `PS1`.

(2) Make sure all unused slots and bays in the chassis are covered with their cover plates.

(3) Plug the power supply cable into the power supply, then into a grounded circuit capable of supplying the required amount of current.

(4) Switch on the power supply. If the chassis contains two power supplies, switch them both on at the same time. Note that the second power supply is upside down relative to the primary supply. Make sure you are setting the switch on both supplies to the on position.

> **NOTE**: If your chassis contains two power supplies, make sure you always turn both of them on at the same time.

If the boot process is successful, a command prompt such as the following is displayed:

```
1:PowerHub:main#
```

If you abort the boot process or an error occurs during booting, the software does not boot. Instead, the following prompt is displayed:

```
<PROM-6pe>
```

To resume the boot process, issue the following command at the `<PROM-6pe>` prompt:

`b [net|fm]`

where:

`net` Boots from the network. (You must configure the hub for netbooting if you specify this option. See Section 2.14 on page 51.)

`fm` Boots from the Flash Memory Module.

If you do not specify a boot source, the boot order configured in NVRAM is used. If you have not configured a boot order, the system attempts to boot first from the Flash Memory Module, then from the network. If your chassis does not contain the Flash Memory Module and you have not yet configured the PowerHub system for network booting, see Section 2.14 on page 51.

If the system does not boot normally, the system might be using the wrong boot definition file. A PowerHub 6000 containing the PowerCell 600 Module must use the `bootdef.atm` file to boot. See the *PowerHub 6000 Release Notes* for information and troubleshooting procedures.

(5) If you have not already copied the latest software files onto the Flash Memory Module (and boot server, if you boot from the network), do so now. See the *PowerHub 6000 Release Notes* for instructions.

(6) Set the boot definition file (used for booting from the Flash Memory Module) to ensure that the ATM software is loaded. To do so, issue the following command:

`nvram set locbdfile bootdef.atm`

(7) Reboot the software by pressing the RST (reset) switch.

2.6 UPGRADING THE POWERCELL SOFTWARE

If your PowerHub system is configured at the factory with the PowerCell module, your system already contains all the required software versions. You do not need to upgrade any software.

However, if you have added the PowerCell module to an installed system, you might need to upgrade software before you can use the PowerCell module. The *PowerHub Release Notes* accompanying your system software contain the latest information regarding software version requirements. The notes also provide instructions for upgrading the software. Make sure to read the *PowerHub Release Notes* accompanying your system software.

2.6.1 Displaying the Installed Software Versions

To display the software versions currently installed on your PowerHub 7000, issue the following command at the runtime command prompt:

`main version [`*`<slot-number>`***`|all]`**

where:

*<slot-number>***|all**	Specifies either a specific NIM slot or all NIM slots in the chassis. The command displays the software versions (system software and boot PROM) installed on the Packet Engine and the intelligent NIM in the specified slot.

Here is an example of the information shown by this command. In this example, the **`all`** argument is used to display version information for the Packet Engine and all the NIMs in the hub. In this example, the hub is a 5-slot PowerHub 7000.

```
1:PowerHub:main# version all
############## Slot 5 ##############

       Card Type: Packet Engine
        Serial #: 538027795
           Model: 7101-00
        Revision: G
           Issue: 1

PowerHub Version: 7-2.6.4.0 1996.12.07 14:02
    PROM Version: 7pep-2.5.4 (s1.76) 1996.11.30 15:41

############## Slot 4 ##############

       Card Type: PowerCell 700 (ATM)
        Serial #: 607027652
           Model: 7401-00
        Revision: C
           Issue: 1

 Runtime Version: 7atm-2.6.4.0 (s1.39) 1996.04.15 2:30
    Prom Version: 7atp-1.1 (s1.4) 1996.04.1 16:15

############## Slot 3 ##############

       Card Type: FDDI Dual DAS Interface Module
        Serial #: 9501AL0037
           Model: 7302-00
        Revision: D
           Issue: 1

 Runtime Version: 7f-2.6.4.0 (s1.71) 1995.12.06 11:10
    Prom Version: 7f-1.7 (s1.7) 1994.11.14 15:17

############## Slot 2 ##############

       Card Type: UTP 13x1 Interface Module
        Serial #: 518020044
           Model: 7350-00
        Revision: C
           Issue: 1

############## Slot 1 ##############

       Card Type: Intelligent NIM - Fast Ethernets
        Serial #: 931UT0002
           Model: 7360-00
        Revision: 1
           Issue: 1

 Runtime Version: 7feth-2.6.4.0 (s1.12) 1995.12.06 11:22
    Prom Version: 7fep-1.1   1995.10.10 16:15
```

If your PowerHub system does not contain all the current software versions (listed in Section 1.1.2 on page 3), you need to upgrade the software. See the *PowerHub 7000 Release Notes* accompanying your system software for instructions.

2.7 ALLOCATING SEGMENTS (POWERCELL 700 ONLY)

The PowerCell 700 can accommodate up to 32 logical segments. You must allocate the segments manually using the **nvram set slotsegs** command. If you do not allocate 32 segments to the slot that contains the PowerCell 700 Module, you cannot use all 32 logical segments on the module. (In addition, you cannot perform a loopback test on the PowerCell 700 unless you allocate all 32 segments to the slot that contains the module.)

You do not need to allocate segments to the PowerCell 600.

To allocate segments for the PowerCell 700, issue the following command from the runtime or the `<PROM-7pe>` command prompt:

nvram set slotsegs[*<slot>***]** *<num-of-segs>*

where:

[*<slot>***]** Specifies the chassis slot number.

> **NOTE**: You must include the brackets around the slot number. They are part of the command you type.

<num-of-segs> Specifies how many segments you want to allocate for the slot. For the PowerCell 700, specify **32**.

Repeat this command for each slot that contains a PowerCell 700.

The segment allocations are stored in the Packet Engine's NVRAM. If you exchange the Packet Engine for some reason, you will need to re-allocate the segments and store the values in the NVRAM on the new Packet Engine. In addition, if you move the PowerCell 700 to another clot in the chassis, you will need to change the segment allocations in NVRAM accordingly.

2.7.1 Verifying the Segment Allocations

To display how many segments are allocated to a particular chassis slot, issue the following command:

nvram show slotsegs[*<slot>***]**

where:

[*<slot>***]** Specifies the chassis slot number. This argument is optional. If you do not specify the slot number, segment allocations for all possible slots (1-15) are displayed.

> **NOTE**: If you use this argument, you must include the brackets around the slot number. They are part of the command you type.

2.8 DISPLAYING THE POWERHUB CHASSIS CONFIGURATION

After the PowerHub system is installed and you have installed the PowerCell module (and allocated segments, if necessary), you can issue the **mgmt showcfg** command to display the chassis configuration and ensure that the PowerCell module is recognized by the PowerHub software.

The following example shows the output of this command on a PowerHub 7000. In this example, the PowerCell 700 is in slot 4, and 32 segments have been allocated for the slot. The ATM segment information is shown in bold type.

```
5:PowerHub:atm# mgmt showcfg
No accelerator board.  Using IOP on the packet engine.
Installed DRAM size: 24 MB.
tty1 not set - using 9600 baud
tty2 not set - using 1200 baud
PE: slot 5

04/19: OC3-SF  OC3-SF  OC3-SF  OC3-SF  OC3-SF  OC3-SF  OC3-SF  OC3-SF
       OC3-SF  OC3-SF  OC3-SF  OC3-SF  OC3-SF  OC3-SF  OC3-SF  OC3-SF
       OC3-SF  OC3-SF  OC3-SF  OC3-SF  OC3-SF  OC3-SF  OC3-SF  OC3-SF
       OC3-SF  OC3-SF  OC3-SF  OC3-SF  OC3-SF  OC3-SF  OC3-SF  OC3-SF
03/13: FIBER   FIBER   FIBER   FIBER   FIBER   FIBER
02/14: BNC     BNC     BNC     BNCT    BNCT    BNCT
01/01: UTP     UTP     UTP     UTP     UTP     UTP     UTP     UTP
       UTP     UTP     UTP     UTP     100TX
```

The PowerCell segments are labeled according to the ATM interface type and the cable type the AMA supports. All the logical segments on an AMA use the same ATM interface type and cable type. In this example, the AMA supports OC-3 (`OC3`) and single-mode fiber (`SF`).

The ATM interface type can be one of the following:

`OC3`	155 Mb/s OC-3 protocol.

The cable type can be one of the following:

`CAT5`	Category 5 (data grade) UTP.
`CX`	75-ohm coaxial cable.
`MF`	Multimode fiber.
`SF`	Single-mode fiber.

To change the ATM interface type or cable type, you must use a different AMA.

The ATM information displayed by the **mgmt showcfg** command on the PowerHub 6000 is similar. The display shows you the PowerCell segment numbers, ATM interface type, and cable type.

2.9 TESTING THE POWERCELL MODULE

To verify proper operation of the PowerCell hardware, you can perform the following self-tests:

loopback test

The PowerHub software comes with scripts for performing two types of loopback tests: external and internal.

- The external loopback test checks the majority of the PowerCell module's digital circuits and the on-board transceivers that drive and receive packets on a PowerCell port. To run the external loopback test on a module, you need a connector that is configured to loop back on itself.
- If you do not have a loopback connector, you still can test the PowerCell module by running the internal loopback test. The internal loopback test checks almost everything the external loopback test checks, except the on-board transceivers that drive and receive packets on the PowerCell port.

You can perform the loopback test on multiple PowerCell modules at a time. However, you can test only one ATM port (PHY) on a module at a time. To test two ports on a PowerCell module, run a loopback test for one of the ports, then repeat the test for the other port.

intelligent-module communication test

Comprehensively tests communication between the Packet Engine intelligent modules. (See Section 2.9.2 on page 43.)

NOTES: Do not run a loopback test when the PowerHub system is attached to a live network. The loopback tests can interfere with network operation.

The intelligent-module communication test can be run when the PowerHub system is attached to a live network, but this test can reduce hub performance during the test.

2.9.1 Running a Loopback Test

Use the following procedure to run a loopback test on the PowerCell module.

(1) Save the PowerHub configuration file onto all the hub's boot sources.

> **NOTE**: If your PowerHub system has more than one boot source, we recommend that you save the configuration file to all of them. You can avoid potential problems by always ensuring that the configuration files on all boot sources match.

(a) (PowerHub 7000 only) To save the PowerHub configuration onto a floppy diskette, insert the BOOT diskette into the floppy drive ***(but do not reboot now!)***, then issue the following command at the runtime command prompt:

`mgmt savecfg fd:cfg`

(b) To save the PowerHub configuration onto the Flash Memory Module, issue the following command:

`mgmt savecfg fm:cfg`

(c) To save the PowerHub configuration onto a TFTP server, issue the following command:

`tftp svcfg [-h` *`<host>`***`]`** *`<remfile>`*

where:

`-h` *`<host>`*	Specifies the IP address of the TFTP server. Unless you have already specified a default TFTP server using the **`tftp set`** command, you need to include the **`-h`** *`<host>`* argument. For information on the **`tftp set`** command and the other **tftp** subsystem commands, see Chapter 4 in the *PowerHub Software Manual*.
`<remfile>`	Specifies the configuration file name. Specify a name that is meaningful to the TFTP program on the server. For example, if the server contains a subdirectory called `fore` and this directory is specified as the TFTP home directory, do not specify `fore` as part of the file name.

> **NOTES**: Some TFTP servers require that the remote file name exist on the server before you can write to that file name. If your server requires that the file name already exist, create a zero-length file (named the same as your configuration file) on the server, then specify that file name for *`<remfile>`*.
>
> Also, on some TFTP servers, including servers running Sun/OS 4.x, files that you overwrite on the server are not properly truncated. When you overwrite an existing file on the TFTP server, if the older version of the file is longer than the new file, the older version is not truncated properly by the server. As a result, the new version of the file contains part of the older version of the file.

(2) Rename the `cfg` file on each boot source. To start a loopback test, you must reboot the PowerHub system without a configuration file. By renaming the `cfg` file, you prevent the hub from loading this file when you reboot.

(a) To rename the `cfg` file on the floppy drive, issue the following command:

`mgmt rename fd:cfg fd:old_cfg`

(b) To rename the `cfg` file on the Flash Memory Module, issue the following command:

`mgmt rename fm:cfg fm:old_cfg`

(c) To rename the file on a boot server, use the commands appropriate for your server. For example, on most UNIX boot servers, you can use the **`cp`** command.

(3) (PowerCell 700 only) Allocate 32 segments to the chassis slot containing the PowerCell 700 you plan to test. You must allocate 32 segments even if you do not plan to use all 32 segments in your live network. (If you need to allocate fewer than 32 segments to the PowerCell 700 for your live network, you can change the segment allocations after you finish testing the module. See Section 2.7 on page 36.)

To allocate segments, issue the following command:

`nvram set slotsegs[`*`<slot>`***`] 32`**

where:

`[`*`<slot>`***`]`**	Specifies the chassis slot number.

> **NOTE**: You must include the brackets around the slot number. They are part of the command you type.

(4) Power off the system by turning the power switches on all the power modules to the OFF position (marked **O**).

(5) Remove all NIMs that you do not plan to test from service. To remove the non-ATM NIMs from service, loosen and partially remove each NIM from the chassis to physically disengage the NIM from the Packet Channel backplane. By disengaging the NIMs, you avoid the need to remove the segment cables attached to your live network.

If you are testing the PowerCell 600, you cannot operate the system if you remove the Packet Engine. To remove the Ethernet segments on the PowerHub 6000's Packet Engine from service, make a note of the segment cables attached to the Ethernet segments, then remove the cables.

> **NOTE**: Make sure you do not remove the PowerCell module you plan to test!

(6) If you have not already installed the PowerCell module you plan to test, do so now using the appropriate procedure in Section 2.3 on page 22. If you plan to use the external loopback test to test PowerCell 700 Modules, make sure you install the PowerCell 700 Modules from chassis slot 1 upward. For example, if you plan to test only one module, install it in chassis slot 1 (the bottom slot). If you plan to test two PowerCell 700 Modules, install them in chassis slots 1 and 2, and so on. You can use the external loopback test to test up to four PowerCell 700 Modules at the same time.

(7) If the PowerCell module you plan to test is connected to your live network, make a note of the connections, then unplug the segment cable(s) from the PowerCell module.

(8) If you have a connector configured to loop back on itself, insert the connector into a port (PHY) on the PowerCell module. After you insert the loopback connector, go to Step 10.

If you do not have a connector configured to loop back on itself, go to Step 9.

> **NOTE**: You can test only one port (PHY) on a PowerCell module at a time. Do not insert a loopback connector in both ports and do not loop the two ports together.

(9) If you are not using a loopback connector, issue the following command to load the `intloop` script, which prepares the system to run the internal loopback test.

```
mgmt rdcfg fd:intloop
```

(To load the script from the Flash Memory Module, issue the following command instead: **`mgmt rdcfg fm:intloop`**.)

Go to Step 11.

(10) If you are using loopback cables, issue the following command to load the `extloop` script, which prepares the system to run the external loopback test.

```
mgmt rdcfg fd:extloop
```

(To load the script from the Flash Memory Module, issue the following command instead: **`mgmt rdcfg fm:extloop`**.)

(11) Start the test by issuing the following command:

```
diag x all 64 1
```

(12) Observe the traffic LEDs on the PowerCell module. When the test is running, the transmit and receive LEDs should glow steadily. If all these LEDs begin to glow as soon as you begin the test and continue to glow steadily without faltering until you end the test, the module has passed this test. Go to Step 13.

If any of the transmit or receive LEDs fail to glow, or if they flicker or hesitate to light immediately, issue the following command to restart the test for the segments that are not responding:

diag x *<seg-list>* **64 1**

where:

<seg-list> Specifies the segment(s) that are not responding. You can specify a single segment or a list of segments. Separate each segment number in a list with a comma.
(Ex: **diag x 1,2,3 64 1**.)

If a segment still fails to respond, reissue the **diag x** command for that segment again. If the segment does not respond after two additional **diag x** commands, contact FORE Systems TAC.

(13) If the PowerCell module you are testing has another port (PHY) or you want to test a port on another PowerCell module, repeat Step 12 for the other port.

(14) Rename the hub's configuration file to `cfg` on all the hub's boot sources.

(a) To rename the `cfg` file on the floppy drive, issue the following command:

mgmt rename fd:old_cfg fd:cfg

(b) To rename the file on the Flash Memory Module, issue the following command:

mgmt rename fm:old_cfg fm:cfg

(c) To rename the file on a boot server, use the commands appropriate for your server. For example, on most UNIX boot servers, you can use the **cp** command.

(15) Power off the hub by turning off the power modules or the power source to which the power modules are connected.

(16) Remove the loopback connector and insert the cables that connect the PowerCell module to your live network.

(17) Power on the hub. If the hub has more than one power supply, remember to switch all the supplies on simultaneously.

2.9.2 Testing Communication Between the Intelligent NIMs and the Packet Engine

To ensure that the PowerCell module and the Packet Engine are communicating with each other properly, run the intelligent-module communication test. On the PowerHub 7000, this test tests communication between the Packet Engine and all the fully installed PowerCell 700 Modules and 6x1FE Modules in the PowerHub chassis. (Modules that are not completely installed are not tested. Modules are completely installed only when the slide latches have been fastened securely in place.)

On the PowerHub 6000, intelligent-module communication test tests communication between the Packet Engine and the PowerCell 600.

> **NOTE**: You cannot use the command described in this section to test your PowerHub 7000 FDDI modules. To run a communication test of your PowerHub 7000 FDDI modules, use the **`diag fddi-cmd`** command for each module. See Appendix A in the *PowerHub 7000 Installation and Configuration Manual* for a description of this command.

2.9.2.1 Starting the Test

To start the intelligent-module communication test, issue the following command:

`ginim ginim-diag-check|gdc start`

Here is an example of this command.

```
7:PowerHub:main# ginim ginim-diag-check start
Starting GINIM diag test in the background ....
```

While this test is running, observe the ATM Engine's S (Status) LED. If the S LED is flashing on and off regularly, the PowerCell module is passing the test. (On the PowerCell 700, only one of the S LEDs needs to be flashing.)

However, if error messages such as the one in the following example are displayed, the PowerCell module is failing the test. An error message is displayed for each PowerCell segment that is failing the test.

If you receive an error message for a segment, do not attempt to use the module in your ATM network. Contact FORE Systems TAC.[2]

```
7:PowerHub:main# ginim ginim-diag-check start
GINIM DIAGNOSTIC TEST FAILED FOR PORT <seg-number>
```

2. Make sure the segment has been allocated in NVRAM. See Section 2.7 on page 36.

2.9.2.2 Stopping the Test

To stop the intelligent-module communication test, issue the following command:

ginim ginim-diag-check|gdc stop

Here is an example of the correct system response when you stop the intelligent-module communication test.

```
7:PowerHub:main# ginim ginim-diag-check stop
GINIM diag test is terminated
```

2.10 CONFIGURING THE POWERCELL MODULE

To use the PowerCell module in your ATM network, you must perform the following tasks:

- Configure the ATM protocol for each PowerCell segment. (See Section 2.10.1.)
- For each ATM protocol you plan to use, configure parameters specific to those protocols. (See Section 2.10.3 on page 47.)

2.10.1 Configuring a PowerCell Segment

To configure the ATM protocol type (and rate group, if applicable) on a PowerCell segment, issue the following command:

atm segment-set|sse *<seg> <param> <value>*
[*<param> <value>***]**

where:

*<segment-list>***|all**

Specifies the PowerCell segment you are configuring.

<param> <value> Specifies the ATM segment parameter and the value you are assigning to the parameter. You can specify one of the following parameters:

protocol|p *<value>*

Specifies the protocol to be used on a segment. You can specify one of the following for *<value>*:

fore-ip|fip FORE IP. (Supported on the PowerCell 700 only.)

lane|l LANE (LAN Emulation) 1.0.

classical-ip|c	RFC 1577 (Classical IP over ATM). (Supported on the PowerCell 700 only.)
bridge-encap|b	RFC 1483 Encapsulation over PVC.
None|n	Removes protocol from segment.(segment must be in a disabled state.)

The default is **lane**.

rate-group|rg *<rate-group>*

Associates a segment with a rate group. Specify a rate group from 1 through 16.

You define the rate groups using the **rate-set** command. See Section A.4.2.1 on page 123. The default rate group for all segments is **1**, which is configured for 155 Mb/s by default.

NOTE: Rate groups are supported on the PowerCell 700 only.

Here is an example of how to set the ATM protocol on a PowerCell segment. In this example, the first command sets PowerCell segment 19 to use the LANE 1.0 protocol. The second command sets PowerCell segment 20 to use the LANE 1.0 protocol. The third command sets PowerCell segment 21 to use the FORE IP protocol.

```
17:PowerHub:atm# segment-set 19 p lane

18:PowerHub:atm# segment-set 20 p lane

19:PowerHub:atm# segment-set 21 p fip

20:PowerHub:atm# segment-set 19 p None
```

Segment numbers depend upon the PowerCell's position in the PowerHub chassis. To display the segment numbers in use by the PowerCell module, issue the **mgmt showcfg** command (see Section 2.8 on page 37).

2.10.2 Verifying the PowerCell Segment Configuration

To verify the configuration of segments on a PowerCell module, issue the **segment-showcfg** command. This command displays the protocol (and rate group, if applicable) you configured on the segment using the **segment-set** command. Here is the syntax for this command:

segment-showcfg|sscf *<seg-list>***|all**

where:

*<seg-list>***|all**	Specifies the segments. You can specify an individual segment number, a comma-separated list of segment numbers, or a hyphen-separated range of segment numbers. If you specify **all**, configuration information is displayed for all the segments on the PowerCell module.

Here is an example of the information displayed by this command. In this example, the ATM configuration for segment 19 is displayed.

```
4:PowerHub:atm# segment-showcfg 19

   Segment             Protocol      State Rate Group
---------- -------------------- ---------- ----------
        19                 lane    Enabled          1
```

The fields in this display show the following information:

`Segment` Lists the PowerHub segment number.

`Protocol` Lists the ATM protocol assigned to the segment. The protocol can be one of the following:

`fore-ip`	FORE IP.
`lane`	LANE (LAN Emulation) 1.0.
`classical-ip`	Classical IP over ATM (see RFC 1577).
`RFC-1483`	RFC-1483 Encapsulation over PVC.

`State` Indicates the state of the ATM protocol. If the protocol is disabled, you can enable it using the appropriate command:

- To enable the FORE IP protocol, use the **`foreip-set`** command.
- To enable the LANE 1.0 protocol, use the **`lec-set`** command.
- To enable the CLIP protocol, use the **`classical-ip-set`** command.
- To enable RFC-1483 Encapsulation, use the **`br-encap-set`** command.

`Rate-Group` Indicates the rate group assigned to the segment.

2.10.3 Configuring Segment Parameters

After you configure the protocol type (and rate group, if applicable) on a PowerCell segment, you can configure ATM protocol parameters on each PowerCell segment. The parameters you configure differ depending upon the ATM protocol type you configured on the segment.

You can find configuration instructions for each ATM protocol type supported by the PowerCell module in the chapters that deal with the specific protocol types:

- To configure LANE 1.0 parameters, see Section 3.5 on page 63.
- To configure parameters for RFC-1483 Encapsulation over PVC, see Section 4.2 on page 88.
- To configure CLIP (Classical IP) parameters, see Section 5.2 on page 102.
- To configure FORE IP parameters, see Section 6.3 on page 109.

2.11 CONNECTING THE POWERCELL MODULE TO THE ATM SWITCH

The following sections describe how to establish physical connection between the PowerHub system and the FORE ATM switch.

2.11.1 Connecting an OC-3 Port

(1) Make sure you have the appropriate cable type for the OC-3 AMA and the switch:

- For the multimode OC-3 AMA, use standard OC-3, multimode fiber-optic cable with SC connectors.
- For the single-mode OC-3 AMA, use standard OC-3, single-mode fiber-optic cable with SC connectors.

(2) Remove the dust covers from the connectors.

(3) Insert the cables into the transmit (X) and receive (R) ports of the AMA.

(4) Insert the other ends of the cables into the FORE switch. Connect the transmit side of the PowerCell port to the receive side of the ATM switch port. Likewise, connect the receive side of the PowerCell port to the transmit side of the ATM switch port.

(5) Power on the hub (if it is not already powered on). At this point, the LNK or L LED for the PowerCell module should illuminate to indicate that the PowerHub system recognizes the FORE switch:

- If the LNK or L LED lights up, the connection is valid. After the PowerHub software boots, the PowerHub system should start transmitting and receiving packets.
- If the LNK or L LED does not light up, recheck the connections and inspect the OC-3 cables for any sign of damage. If the LNK LED still does not light up, call FORE Systems TAC.

(6) Check the transmit (X) and receive (R) LEDs to make sure that packets are being received on and sent from the PowerHub system. If these LEDs are not illuminated, call FORE Systems TAC.

2.11.2 Connecting a TP-PMD Port

(1) Make sure the cable is wired with the appropriate pinouts:

- For the pinouts on the ATM switch, see the documentation for the switch.
- For the pinouts on the PowerCell TP-PMD AMA, see Table 2–1.

TABLE 2–1 RJ-45 pinouts—TP-PMD AMA.

Pin No.	Signal Name	Hub	Workstation (DTE)
1	XMT POS	Output	Output
2	XMT NEG	Output	Output
3	Pseudo-ground	Pseudo-ground	Pseudo-ground
4	Pseudo-ground	Pseudo-ground	Pseudo-ground
5	Pseudo-ground	Pseudo-ground	Pseudo-ground
6	Pseudo-ground	Pseudo-ground	Pseudo-ground
7	RCV POS	Input	Input
8	RCV NEG	Input	Input

(2) Insert the RJ-45 connectors into the PowerCell port and the corresponding port on the ATM switch.

(3) Power on the hub (if it is not already powered on). At this point, the LNK or L LED on the ATM module should illuminate to indicate that the PowerHub system recognizes the FORE switch:

- If the LNK or L LED lights up, the connection is valid. After the PowerHub software boots, the PowerHub system should start transmitting and receiving packets.
- If the LNK or L LED does not light up, recheck the connections and inspect the TP-PMD cables for any sign of damage. If the LNK or L LED still does not light up, call FORE Systems TAC.

(4) Check the transmit (X) and receive (R) LEDs to make sure that packets are being received on and sent from the PowerHub system. If these LEDs are not illuminated, call FORE Systems TAC.

2.12 DISPLAYING THE STATE OF A SEGMENT

The *automatic segment-state detection feature* detects the physical and logical states of the PowerCell ATM segments. See Section 1.3.4 on page 17 for information about how the segment-state is reported for the PowerCell module.

The automatic segment-state feature is enabled by default.

> **NOTE**: If you disable automatic segment-state detection on a segment, the segment's state is always reported as "good" and corresponding interface states are always reported as "up" in the software. To make sure the software is reporting a segment's or interface's state, enable automatic segment-state detection for that segment.

When a segment is disabled, no packets are bridged or routed to or from that segment. This is true whether the segment is disabled by the automatic segment-state detection feature or by you, issuing the **`bridge port`** command. (See Chapter 2 in the *PowerHub Software Manual* for further information about the **`bridge port`** command.)

Note that if you use the **`bridge state`** command to display state information for a segment, the state displayed in the `Management` field is "disabled" if the segment is disabled by the **`bridge port`** command, but remains "enabled" if the segment is disabled by automatic segment-state detection.

To display the state of a segment or to disable automatic segment-state detection on a segment, issue the following command:

`mgmt autoportstate|aps [`*`<seg-list>`***`|all enl|dis]`**

2.13 VERIFYING NETWORK CONNECTIONS

If you want to verify connection between the PowerHub system and another device, you can add an IP address to a PowerHub segment, then use the **ip ping** command to ping other devices attached to that segment. Here is the syntax for adding an IP interface to the PowerHub system. For additional information about the PowerHub IP software and the **ip ping** command, see Chapter 5 in the *PowerHub Software Manual*.

To add an IP interface to a PowerHub segment, telnet to the hub, or establish a connection through a TTY link, and issue the **ip add-interface** command. The syntax of the command is as follows:

```
ip add-interface|ai <seg-list> <IP-addr>
                    [<subnet-mask> [br0|br1]
                    [cost <cost>] [allsubnets|as]]
```

where:

<seg-list>	Specifies the segment(s) to which you are assigning the IP address. You can specify a single segment, a comma-separated list of segments, a hyphen-separated range of segments, or **all** for all segments. If you specify multiple segments, you create a VLAN. (See Appendix D in the *PowerHub Software Manual* for information about VLANs.)
<IP-addr>	Specifies the IP address you want to assign to the specified segment(s). The IP address must be in dotted-decimal notation (four decimal numbers in the range 0 through 255, separated by dots).
<subnet-mask>	Specifies the subnet mask. If a particular network uses IP subnet addressing, then the subnet mask should be specified here using dotted-decimal notation. Otherwise, the system uses a default subnet mask equal to the "natural" subnet mask for the particular class of address.
br0|br1	Specifies the style of broadcast address on a segment-by-segment basis: • When you specify **br0**, the hub sends an "all-0s" broadcast. This means all bits in the host segment of the address are 0s. • When you specify **br1**, the hub sends a standard "all-1s" broadcast. This means all bits in the host segment of the address are 1s. The default is **br1**.
cost *<cost>*	Specifies an additional cost of using the subnet interface. This is the number of extra hops to the destination. The range is **1** through **14**. (The router decrements an IP packet's time-to-live field at each hop.) The default is zero. When the hub reports this subnet using RIP, it adds the additional cost to the reported metric.

> **NOTE**: The cost you specify using the **cost** argument is used only by RIP, not by OSPF.

allsubnets|as Lets you specify all zeros or all ones in the subnet mask. You must use this argument if you specify either of the following subnet masks: **`0.0.0.0`** or **`255.255.255.255`**.

For information about the **`ip add-interface`** command and other commands in the **ip** subsystem, see Chapter 5 in the *PowerHub Software Manual*.

2.14 CONFIGURING THE BOOT SOURCE

You can configure the PowerHub system to boot the software from one of the following sources:

- The Flash Memory Module.
- A TFTP server (network booting or "netbooting").
- A system software diskette in the floppy drive (PowerHub 7000 only).

You can configure the hub to use one method exclusively, or to try a specific method first, then try the other method(s) if the first method fails.

If you boot the hub from the floppy drive or the Flash Memory Module, no connection to the network is required. However, if you boot the hub from a TFTP server, you must attach the hub to the file server using a segment cable.

To configure the boot sources, follow the instructions in the appropriate manual:

PowerHub 7000	Chapter 6 in the *PowerHub 7000 Installation and Configuration Manual.*
PowerHub 6000	Chapter 4 in the *PowerHub 6000 Installation and Configuration Manual.*

The sections listed above describe how to perform the following tasks:

- Specify the boot order (**`nvram set bo`** command).
- Configure the hub for netbooting.

If you configured your PowerHub system for netbooting, you need to add the pathname for the ATM software to the boot definition file (`bootdef`) on the boot server.

2.14.1 PowerHub 7000 Example

Here is an example of the boot definition file contained on the BOOT diskette (and Flash Memory Module, if present) for a PowerHub 7000.

```
%vstart 0
7pe      m
%vend 0
```

Here is an example of a boot definition file that has been copied onto a boot server and modified to contain the pathnames to the PowerHub system's configuration file and software image files. Make sure you specify the pathnames that make sense on your boot server.[3]

```
%vstart 1
fore/ph/configs/0000EF014A00.cfg    c
fore/ph/images/7-2640/7pe           m
%vend 1
```

NOTE: Some boot definition files contain the lines `%vstart 0` and `%vend 0`. These are used for booting from a floppy drive and do not work for netbooting. Make sure you change the boot definition files you use for netbooting by replacing "`%vstart 0`" and "`%vend 0`" with "`%vstart 1`" and "`%vend 1`".

2.14.2 PowerHub 6000 Example

The PowerHub 6000's Flash Memory Module contains the following boot definition files:

`bootdef` — Used for systems that do not contain the Single DAS FDDI daughter card. This boot definition file loads the Packet Engine runtime software. The `bootdef` file is configured at the factory as the default boot definition file for systems that do not contain FDDI or ATM daughter cards.

`bootdef.atm` — Used for systems that contain the PowerCell 600 ATM daughter card. This boot definition file loads the Packet Engine runtime software and the ATM software. The `bootdef.atm` file is configured at the factory as the default boot definition file for PowerHub 6000s that contain the ATM daughter card.

`bootdef.ppu` — Used for loading the PROM Programming Utility. This boot definition file is used only when upgrading the Packet Engine boot PROM.

To boot a PowerHub system containing the PowerCell 600, you need to use `bootdef.atm`. If you use another boot definition file instead of `bootdef.atm`, the system will not work properly. See the *PowerHub 6000 Release Notes* for information.

Here is an example of the `bootdef.atm` file.

```
%vstart 1
6pe      m
6atm     h
%vend 1
```

3. See Appendix B in the *Installation and Configuration Manual* for your PowerHub system for information about pathnames and other topics related to netbooting.

Here is an example of a boot definition file that has been copied onto a boot server and modified to contain the pathnames to the PowerHub system's configuration file and software image files. Make sure you specify the pathnames that make sense on your boot server.[4]

```
%vstart 1
fore/ph/configs/0000EF014A00.cfg    c
fore/ph/images/6-2640/6pe           m
fore/ph/images/6-2640/6atm          h
%vend 1
```

2.15 SAVING THE POWERHUB CONFIGURATION

When you use software commands to change the PowerHub system configuration, the hub does not retain these changes after you power down or reboot the system. (However, changes made to the NVRAM are saved.) You can preserve configuration changes by saving them to a configuration file.

When you boot the PowerHub system, the software looks for a configuration file on the device you specified as the boot source. When the PowerHub system reads the configuration file, the configuration changes you saved in the file are reinstated on the hub. The configuration file name is specified in the boot definition file:

- (PowerHub 7000 only) If the software is booted from the floppy drive, the boot definition file on the floppy diskette identifies a configuration file name on the floppy diskette. By default, the `bootdef` file identifies the name `cfg`. (You can change the default configuration name in the boot definition file by editing the file.)
- If the software is booted from the Flash Memory Module, the boot definition file on the Flash Memory Module identifies a file name on the module. By default, the boot definition file identifies the name `cfg`. (You can change the default configuration name in the boot definition file by editing the boot definition file.)
- If the software is booted from a BOOTP/TFTP server, the boot definition file identifies a file named *`<file-name>`*`.cfg`, where *`<file-name>`* identifies the PowerHub system.

> **NOTE**: If you plan to use more than one boot source, we recommend that you issue the commands for saving the configuration onto each boot source. These procedures are described in the following sections. You can avoid potential problems by always ensuring that the configuration files on all boot sources match.

4. See Appendix B in the *Installation and Configuration Manual* for your PowerHub system for information about pathnames and other topics related to netbooting.

2.15.1 Floppy Drive

To save the current configuration onto the diskette in the floppy drive:

(1) Boot the software if you have not already done so. Following the boot messages, a command prompt similar to the following is displayed:

```
1:PowerHub:
```

> **NOTE**: The software must be successfully booted before you can save the configuration. You cannot save the configuration from the `<PROM-7pe>` prompt.

(2) Type the following command at the prompt, then press Enter:

`mgmt svcfg fd:cfg`

This command saves the configuration into a file named `cfg` on the floppy diskette. You can specify any DOS-like file name. If you specify a name that does not match the name (`cfg`) in the boot definition file, you must load the configuration manually each time you boot the software by using the **`mgmt rdcfg`** command.

2.15.2 Flash Memory Module

To save the current configuration onto the Flash Memory Module:

(1) Boot the software if you have not already done so. Following the boot messages, a command prompt similar to the following is displayed:

```
1:PowerHub:
```

> **NOTE**: The software must be successfully booted before you can save the configuration. You cannot save the configuration from the `<PROM-7pe>` prompt or `<PROM-6pe>` prompt.

(2) Type the following command at the prompt, then press Enter:

`mgmt svcfg fm:cfg`

This command saves the configuration into a file named `cfg` on the Flash Memory Module. You can specify any DOS-like file name. If you specify a name that does not match the name (`cfg`) in the boot definition file, you must load the configuration manually each time you boot the software by using the **`mgmt rdcfg`** command.

2.15.3 TFTP Server

To save the PowerHub configuration file onto a TFTP server, you can do either of the following:

- Save the configuration file to the floppy drive using the procedure in Section 2.15.1 on page 54, then copy the file from the diskette to the server.
- Define an IP interface on the PowerHub segment attached to the TFTP server, then use the PowerHub TFTP software to save the configuration into a file on the server. This section describes how to do this.

(1) Boot the software if you have not already done so. Following the boot messages, a command prompt similar to the following is displayed:

```
1:PowerHub:
```

> **NOTE**: The software must be successfully booted before you can save the configuration. You cannot save the configuration from the boot PROM prompt.

(2) Attach a segment cable from the PowerHub system to the TFTP server.

(3) Define an IP interface on the segment that connects the hub to the server by issuing the following command.

ip add-interface|ai *<seg-list> <IP-addr>*
[*<subnet-mask>* **[br0|br1]**
[cost *<cost>***] [allsubnets|as]]**

The command arguments are described in Section 2.13 on page 50.

(4) Enable IP forwarding by issuing the following command:

ip set ifw

(5) Type the following command at the prompt, then press Enter:

tftp svcfg [-h *<host>***]** *<remfile>*

where:

-h *<host>* Specifies the IP address of the TFTP server. Unless you have already specified a default TFTP server using the **tftp set** command, you need to include this argument. For information on the **tftp set** command, see the *PowerHub Software Manual*.

<remfile> Specifies the configuration file name. Specify a name that is meaningful to the TFTP program on the server. For example, if the server contains a subdirectory called fore and this directory is specified as the TFTP home directory, do not specify fore as part of the file name.

NOTES: This command saves the IP interface you defined in Step 3.

Some TFTP servers require that the remote file name exist on the server before you can write to that file name. If your server requires that the file name already exist, create a short file (named the same as your configuration file) on the server, then specify that file name for `<remfile>`.

Also, on some TFTP servers, including servers running Sun/OS 4.x, files that you overwrite on the server are not properly truncated. When you overwrite an existing file on the TFTP server, if the older version of the file is longer than the new file, the older version is not truncated properly by the server. As a result, the new version of the file contains part of the older version of the file.

If the configuration file name you specified in the boot definition file on the server is longer than eight characters, you can copy the file to the server using a DOS-like name, then rename the file on the server to match the file name you specified in the boot definition file.

3 LANE 1.0

The PowerCell software supports the ATM Forum's *LANE (LAN Emulation) 1.0* and *UNI (User-Network Interface) 3.0*, ATM standard protocols that let you associate a logical segment on the PowerCell module with an *ELAN (Emulated LAN)*. An *ELAN* is a group of ATM stations that appear to the PowerHub system as an Ethernet segment (broadcast domain). From the PowerCell module's perspective, ATM stations grouped into an ELAN appear to be nodes on a single Ethernet segment. You can associate each PowerCell segment with a separate ELAN.

LANE (LAN Emulation) 1.0 overlays your Ethernet and FDDI LANs on top of an ATM network. The PowerCell module can be used to overlay the Ethernet, Fast Ethernet, and FDDI networks managed by your PowerHub system onto ATM. You associate each logical segment on the PowerCell module with an ELAN configured on the ATM switch attached to the PowerCell module.

3.1 ETHERNET LAN CHARACTERISTICS EMULATED BY LANE 1.0

LANE 1.0 emulates the following characteristics of Ethernet LANs:

Connectionless service	LANE establishes VCs (virtual circuits) to bridge traffic between the Ethernet LAN and ATM, but the VCs are transparent to the Ethernet LAN equipment.
Broadcast and multicast service	The BUS (Broadcast and Unknown Server) is a component of LANE that emulates broadcast and multicast services. When the PowerCell module needs to forward broadcast or multicast traffic from the Ethernet network, the module sends the traffic to the BUS, which in turn sends the traffic to each of the destination nodes in the ATM network.

Figure 3–1 shows an example of an ATM network using LANE 1.0. Notice that each ATM station is a member of an ELAN. In this example, the stations are grouped into two ELANs: ELAN1 and ELAN2.

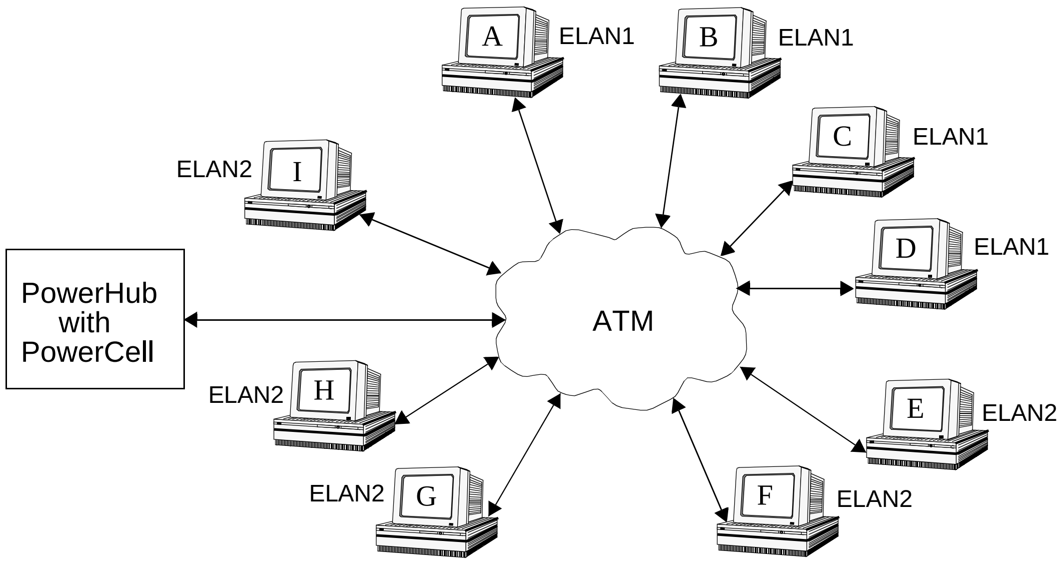


FIGURE 3–1 ATM LANE 1.0 network containing ELANs.

Figure 3–2 shows the same ATM LANE 1.0 network from the PowerHub system's perspective. Notice that the ATM stations are still grouped into the same ELANs. However, the PowerHub software regards each ELAN as an independent Ethernet segment.

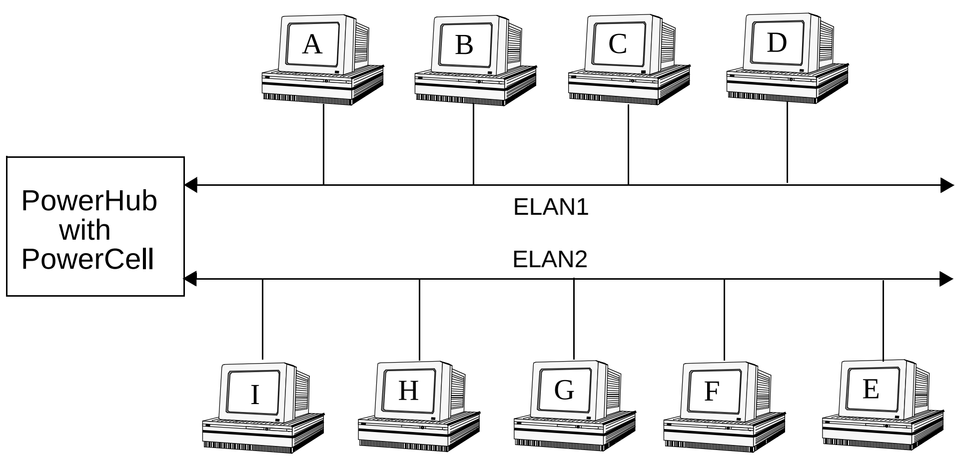


FIGURE 3–2 ATM LANE 1.0 network containing ELANs—PowerHub view.

Because ATM stations grouped in an ELAN appear to the PowerHub software as members of a single Ethernet segment, all the configuration features and management features available on the PowerHub system for Ethernet segments also are available for ELANs. The features include 802.1d bridging, the Spanning-Tree algorithm, IP, IPX, AppleTalk, and DECnet routing protocols, and RIP, as well as automatic segment-state detection, bridge groups, and VLANs. See Chapter 1 in your PowerHub system's *Installation and Configuration Manual* for an overview of the PowerHub software features.

3.2 THE POWERCELL MODULE AND LANE 1.0

The following sections describe the LANE 1.0 components and the role the PowerCell module plays in your LANE 1.0 network.

3.2.1 LANE 1.0 Components

LANE 1.0 networks contain four major components:

LEC (LAN Emulation Client)

The LEC is the component in an end system that performs data forwarding, address resolution, and other functions when communicating with other components of an ELAN. The PowerCell module can be configured as a LEC.

When you enable the PowerCell module as a LEC, the PowerCell software performs data forwarding, address resolution, and other control functions when communicating with other components of the ELAN.

LECS (LAN Emulation Configuration Server)

The LECS is responsible for the initial configuration of a LEC. The LECS provides the LEC information about the ELANs that the LEC can join. The LECS also provides the LEC the address of the LES (see below) associated with each ELAN.

You can configure the LECS on an ATM host such as a UNIX workstation, or on a FORE Systems ATM switch.

LES (LAN Emulation Server)

The LES is an LE_ARP (LAN Emulation ARP) server and contains address resolution information for an ELAN. The LES contains a table that maps the MAC address of each device in the ELAN to its corresponding ATM address.

You can configure the LES on the ATM switch or on the PowerCell 700. (You cannot configure the LES on a PowerCell 600.)

BUS (Broadcast and Unknown Server)

The BUS emulates the multicast and broadcast functions of an Ethernet segment. When the LEC needs to send a broadcast or multicast packet, or does not know the destination of a unicast packet, the LEC sends the packet to the BUS. The BUS then sends the packet to the appropriate end systems.

You can configure the BUS on the ATM switch or on the PowerCell 700. (You cannot configure the BUS on a PowerCell 600.)

3.2.2 The Problem Solved by Using the PowerCell Module with LANE 1.0

Figure 3–3 shows an example of an ATM switch connected to multiple LANE 1.0 ELANs. In this configuration, the ATM switch cannot directly bridge or route traffic from one ELAN to another.

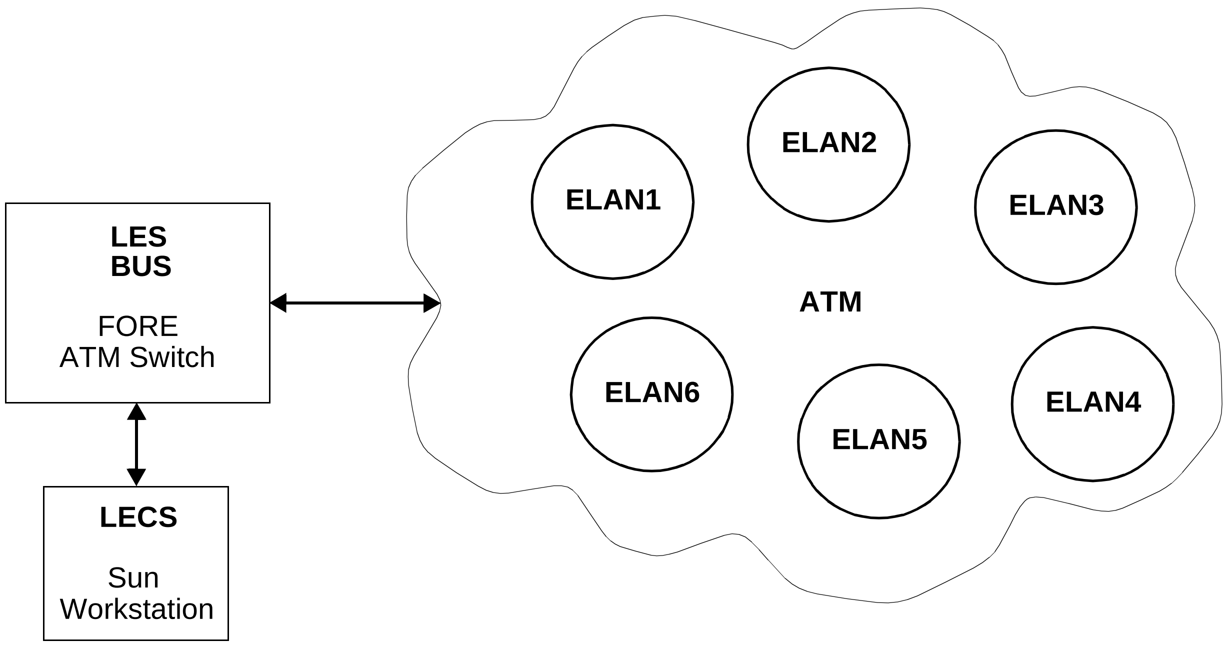


FIGURE 3–3 Example of a LANE 1.0 network.

In Figure 3–3, the ATM switch is bridging or routing traffic within each of the ELANs configured on the switch. However, the ATM switch cannot bridge or route from one ELAN to another. For example, traffic from ELAN1 cannot be bridged or routed to ELAN2.

Figure 3–4 shows how adding the PowerCell module to your ATM network enables you to bridge and route among LANE 1.0 ELANs.

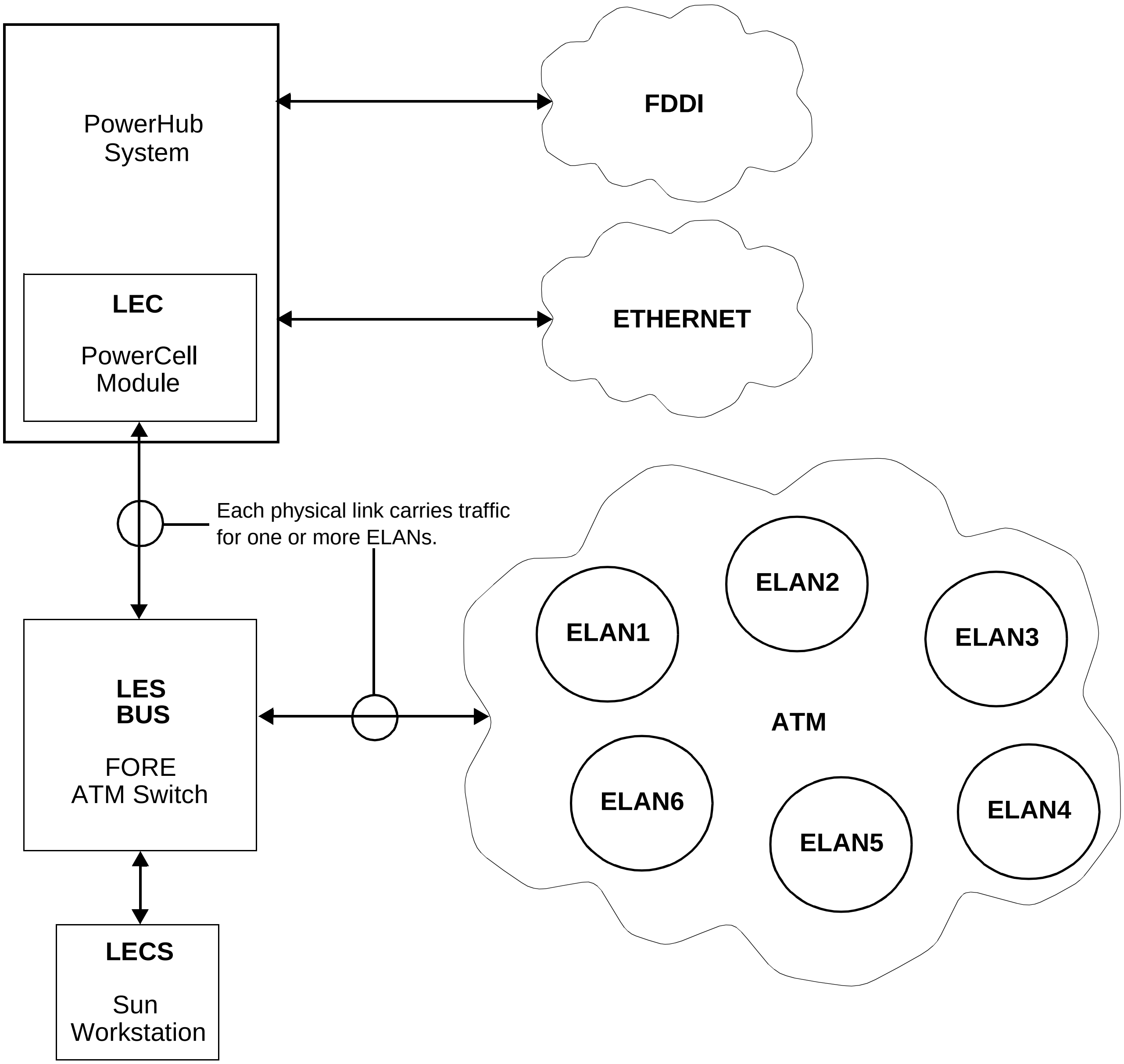


FIGURE 3–4 Example of a LANE 1.0 network using a PowerCell module.

As shown in this example, a PowerCell module has been added to the ATM network. LANE 1.0 traffic from one ELAN to another is sent by the ATM switch to the PowerCell, which uses its on-board ATM processing software to forward the traffic to the appropriate ELAN. For example, traffic sent from ELAN1 to ELAN2 is received by the ATM switch, which sends the traffic to the PowerCell module. The PowerCell module receives the LANE 1.0 packets, removes the LANE 1.0 headers, then examines the destination and source addresses of the packet for forwarding information.

Traffic sent from the PowerHub system's Ethernet or FDDI segments to devices in an ELAN are translated by the PowerCell module from Ethernet packets into ATM cells, then sent to the ELAN.[1] Traffic sent by an ELAN to an Ethernet or FDDI segment is translated by the PowerCell module into Ethernet or FDDI packets, then sent to the appropriate PowerHub segments.

3.3 LOCAL LES AND BUS

In software version 7-2.6.4.0 and later, you can configure the LES and BUS on the PowerCell 700 itself.

> **NOTE**: The local LES and BUS are not supported on the PowerCell 600.

A LES or BUS configured on the PowerCell 700 is called a local LES or local BUS in this addendum. Depending upon your configuration needs, you can configure both the LES and BUS on the PowerCell 700 or just one or the other. If you configure both the LES and the BUS on the PowerCell module, the LES and BUS are colocated.

A colocated LES and BUS share address resolution information. Therefore, by colocating the LES and BUS, you can optimize the forwarding of unknown packets provided by the LES and BUS.

To configure a LES or BUS or a colocated LES and BUS on the PowerCell 700, use the procedure in Section 3.5.3 on page 71.

3.4 LEC FAILOVER SUPPORT

The PowerHub software supports *ForeThought*'s LEC (LAN Emulation Client) failover mechanism. The *LEC failover mechanism* provides redundancy by letting you associate an ELAN (Emulated LAN) with multiple LESs (LAN Emulation Servers). The ELAN uses only one of the LESs for ELAN traffic, but if that LES fails, the software automatically uses another LES. You can specify up to two backup LESs for each ELAN.[2] For information on configuring the LEC failover mechanism on the PowerCell module, see Section 3.5.4 on page 75.

---

1. The ATM LANE 1.0 specification does not deal with translating FDDI packets directly into ATM. The PowerHub system can translate traffic between FDDI and ATM while still adhering to the ATM LANE 1.0 standards because the PowerHub system changes FDDI packets into Ethernet packets internally before translating them into ATM cells.

2. This section describes how to use the failover mechanism on the PowerCell module. For information about using the failover mechanism on a FORE ATM switch, see the *ForeRunner ATM Switch Configuration Manual*.

3.5 CONFIGURING FOR LANE 1.0

To use the PowerCell module for bridging and routing in a LANE 1.0 ATM network, you must perform the following configuration tasks:

- Prepare your other ATM hardware for LANE 1.0.
- Add ELANs (Emulated LANs) to the segments you allocated to the PowerCell module. The ELAN names must match the ELAN names you specified when you configured the LECS on the ATM switch. (Use the **`elan-configure`** command or the **`elan-add`** command.)
- If you use the **`elan-add`** command instead of the **`elan-configure`** command, enable the PowerCell module to get configuration information from the LECS (LAN Emulation Configuration Server) and enable (start) the LEC. If you use the **`elan-configure`** command, the LECS is enabled automatically. (If you do not use LECS to get configuration information, you must specify the LES address when you add an ELAN to the LEC.)

The following sections describe how to perform these tasks.

3.5.1 Configuring Other ATM Hardware for LANE 1.0

3.5.1.1 LES and BUS

If you plan to use the PowerCell module as a LEC (LAN Emulation Client) for LANE 1.0, the following items must be defined within your ATM network:[3]

- LES (LAN Emulation Server).
- BUS (Broadcast and Unknown Server).

You can configure the LES and BUS on the ATM switch, on a UNIX workstation configured with an SBA-200 Adapter Card, or on the PowerCell 700.

The following sections describe how to configure the ASX ATM Switch, an SBA-200 Adapter Card, and a PowerCell 700. Each procedure contains steps for configuring the LES and BUS. You need to configure the LES and BUS on only one device for each ELAN supported by the devices.

- To configure the LES and BUS on the SBA-200 ATM Adapter Card, see Step 2 in the procedure in Section 3.5.1.3 on page 64.
- To configure the LES and BUS on the ASX ATM Switch, see Steps 2 and 3 in the procedure in Section 3.5.1.4 on page 65.
- To configure the LES and BUS on the PowerCell 700, see Section 3.5.3 on page 71.

3. See Section 3.2 on page 59 for definitions of the LANE 1.0 components.

3.5.1.2 LECS

In addition to the LES and BUS (which are required), you can configure the LECS (LAN Emulation Configuration Server). The LECS is optional. The LECS supplies the LES address to the LEC (PowerCell module). If you do not configure the LECS, you must supply the LES address manually when you add an ELAN to the PowerCell module. Note that the LECS cannot reside on the PowerHub system. It must be located on the ATM Switch or a host with an SBA ATM adapter card.

The following sections contain configuration instructions for bringing up LANE 1.0 services on the SBA-200 Adapter Card and the FORE ATM switch. For further information about how to configure the other configuration items, see Chapter 3 in the *ForeRunner ATM Switch Configuration Manual*.

After you configure the Adapter cards and ATM switch for LANE 1.0, use the commands described in Section 3.5.2 on page 65 to configure the PowerCell module for LANE 1.0.

See Section 3.6 on page 81 for example LANE 1.0 configurations. The examples include a LES, BUS, LECS, and LEC.

3.5.1.3 Starting LANE Services on the SBA-200 ATM Adapter Card

The following procedure shows how to start LANE services on an SBA-200 ATM Adapter card.

(1) Issue the following command:

`lane start lecs -f /usr/fore/etc/lecs.cfg -s 0x1`

The **`-s`** option above allows you to give the Selector byte for the LECS. If you do not use this option, the Selector byte defaults to 0x0.

You also can specify the **`none`** option at the end to ensure that the LECS does not respond to the WELLKNOWN address. The `lecs.cfg` file does not need to be located in the `/usr/fore/etc` directory, although that is the preferred place.

Make sure that the addresses in the `lecs.cfg` file are in the following format:

`default.Address: 47000580ffe1000000f21a012700204806136f15`

(2) To configure the LES and BUS on the adapter card, issue the following command. Issue this command only if you do not plan to configure the LES and BUS on the ATM switch or the PowerCell 700:

`lane start le -ibus` *`<LES-sel-byte> <BUS-sel-byte>`*

The Selector byte for the LES you specify must match the Selector byte you specified in the `lecs.cfg` file for the particular ELAN. You need to issue this command each time for a LES/BUS pair you want to start.

You can start the LES and the BUS in the foreground by issuing the command:

`le -ibus` *`<LES-sel-byte> <BUS-sel-byte>`*

(3) Issue the following command:

`elconfig set -lecs` *`<LECS-address>`***`|-wellknown`**

This command sets the LECS address for the Client on the SPARC workstation. This command must be executed on every SPARC workstation on which you want to configure a LEC.

(4) Issue the following command:

`elconfig add` *`<elan-name>`*

Issue this command for every LEC that you want to join a specific ELAN.

(5) Issue the following command:

`elconfig delete` *`<elan-name>`*

Issue this command for every ELAN you want to delete on a specific host.

(6) Verify operation by issuing the following command:

`atmarp -z qaa0`

If this command displays zeroes, double-check your configuration. Traffic is not being passed properly.

3.5.1.4 Starting LANE Services on the FORE ATM Switch

The following procedure shows how to start LANE services on a FORE Systems ATM Switch.

(1) Issue the following command from the `configuration->lane->lecs` prompt:

`new` *`<LECS-sel-byte>`* **`-db lecs.cfg`**

(2) To configure the LES on the ATM switch, issue the following command. Issue this command only if you do not plan to configure the LES and BUS on a workstation using an ATM Adapter Card or on the PowerCell 700. Issue the following command from the `configuration->lane->les` prompt.

`new` *`<LES-sel-byte> <BUS-sel-byte> <elan-name>`*

(3) To configure the BUS on the ATM switch, issue the following command. Issue this command only if you do not plan to configure the LES and BUS on a workstation using an ATM Adapter Card or on the PowerCell 700. Issue the following command from the `configuration->lane->bus` prompt.

`new` *`<BUS-sel-byte> <elan-name>`*

3.5.2 Configuring the PowerCell Module for LANE 1.0

The following sections describe the commands you use to configure the PowerCell module for LANE 1.0.

The commands used to configure the PowerCell for LANE 1.0 are located in the **atm** subsystem. To access the **atm** subsystem, issue the following command at the runtime prompt:

`atm`

If you issue the **atm** subsystem commands within the **atm** subsystem, it is not necessary to use the **atm** prefix on the commands.

3.5.2.1 *Adding an ELAN using the* `elan-configure` *command*

The **`atm elan-configure`** command simplifies the process of adding ELANs to PowerCell segments by replacing the **`atm elan-add`**, **`atm elan-del`**, and **`atm lec-set`** commands. When using the **`atm elan-configure`** command, the parameters and values applied when the first segment is configured are applied to the entire slot. The **`atm elan-configure`** command does not require that you disable and then re-enable the slot for changes to take effect, as is the case with the **`atm elan-add`**, **`atm elan-del`**, and **`atm lec-set`** commands.

> **NOTE**: After you have used the **`elan-add`**, **`elan-del`**, or **`lec-set`** commands to configure your ELANs, you can use the **`elan-configure`** command to change the configuration. However, after you use the **`elan-configure`** command, do not use the **`elan-add`**, **`elan-del`**, or **`lec-set`** commands again.
> The **`elan-configure`** command replaces them. Using the **`lec-set`** command after using the **`elan-configure command`** may disable the slot and require you to delete and then re-add all ELANs.

Before you add an ELAN to a PowerCell segment, the segment must be configured for the LANE 1.0 protocol. To make sure that the required segments have been configured for LANE 1.0, issue the **`atm segment-showcfg`** command with the **`all`** parameter. If the segments have not been configured, use the **`segment-set`** command to configure the segment(s). See Section 2.10 on page 44 for information on configuring segments on the PowerCell module.

When the segments are allocated, you can join the PowerCell LEC to an ELAN.

Issue the following command to associate a PowerCell segment with the ELAN you want to join:

`elan-configure|elco` *<elan-name> <segment> <param> <value>*

[<param><value>`...`*[<param><value>]]*

where:

<elan-name>	Specifies the name of the ELAN you wish to add or delete.
<segment>	Specifies the segment number of the ELAN you wish to add or delete.
<param> <value>	Specifies the configuration parameter and the value you are assigning to the parameter. You can specify one or more of the following parameters:

`state|s enl|dis`

Enables or disables the use of the LECS by the LE Client on the specified segment.

If the **`state`** parameter is used with the value **`enl`**, and you do not specify the LES address using the **`les-address`** or **`lecs-usage`** parameter, the well-known address is used.

If the **`dis`** value is used, the ELAN is removed from the segment.

The **`state`** parameter is necessary for the LE Client to join the network.

`les-address|la <les-atm-address>`

Specifies ELAN LES address. The **`les-address`** parameter is required when the LECS has not been configured or when the LECS usage is not set. The LE Client forms a connection directly to the specified LES instead of the LECS.

`lecs-usage|lu <lecs-atm-address>`

Specifies the LECS to be used by the LE Client. When the **`lecs-usage`** parameter is used, the well known address is not used, but an LECS is enabled using the address provided. This parameter is used when the LECS is not located at the well-known address, and the **`les-address`** parameter is not set.

> **NOTE**: The **`lecs-usage`** command that is used to configure the first segment is applied to the entire slot. If you wish to change the lecs usage for the slot, you must first disable all ELANs using the **`elan-configure`** command with the **`state dis`** parameter and value. Then the parameters set for the first ELAN that you reconfigure will be applied to the entire slot.

Here is an example of how to add an ELAN to the PowerCell module. In this example, an ELAN named “elan1” is added to segment 19, the segment is enabled and the LECS is joined using the LECS well-known address.

```
5:PowerHub:atm# elan-configure elan1 19 state enl
```

> **NOTE**: With the **`elan-configure`** command, you do not need to specify a slot when you enable the LECS. The **`elan-configure`** command automatically enables the slot when you configure the first segment.

You can add a particular ELAN to only one PowerCell segment and the ELAN name must be unique among the PowerCell segments in the same PowerHub chassis. In addition, the ELAN name you specify must match the ELAN name you configured on the FORE switch.

If you did not configure the LECS, you must specify the LES address when you add the ELAN to the PowerCell module. Here is an example of how to specify the LES address with the **elan-configure** command.

```
6:PowerHub:atm# elan-configure elan1 19 state enl les-address
47:0079:0000:0000:0000:0000:0000:00a03e000001:00
```

3.5.2.2 *Adding an ELAN using the* `elan-add` *command*

FORE Systems recommends that you use the **elan-configure** command to add ELANs to the PowerCell module. The **elan-configure** command eliminates the need to type two commands in order to create and enable an ELAN, and allows you to add an ELAN without having to disable and then re-enable the LEC on the slot. However, the **elan-add**, **elan-del**, or **lec-set** commands are still functional. If you currently are using the **elan-add**, **elan-del**, or **lec-set** commands, you can switch to the **elan-configure** command, but once you begin using the **elan-configure** command, *do not* use the **elan-add**, **elan-del**, or **lec-set** commands.

> **NOTE**: If you use the **elan-configure** command, do not use the **elan-add**, **elan-del**, or **lec-set** command. Using the **lec-set** command may disable the ELANs configured with the **elan-configure** command and require you to delete and then re-add those ELANs. The **elan-configure** command replaces the need to type two commands when enabling or disabling ELANs.

To join the PowerCell LEC to an ELAN:

(1) If you previously enabled the LEC on the PowerCell module using the **elan-add** command and do not wish to use the **elan-configure** command, disable the LEC on the PowerCell module by issuing the following command:

lec-set|lse *<slot>***|all lecs-usage dis state dis**

where:

*<slot>***|all**	Specifies the slot that contains the PowerCell module. • On the PowerHub 7000, the slots are labeled on the PowerHub chassis. • On the PowerHub 6000, the PowerCell 600 is always in slot 2. On both PowerHub models, you also can determine the slot number using the **mgmt showcfg** command.

> **NOTE**: If you add an ELAN before you disable the LEC on the PowerCell module, the new ELAN will be listed when you issue the **`segment-showconfig`** command, but will not be enabled. To enable the new ELAN, you must first disable and then re-enable the LEC using the **`lec-set`** command.

(2) Issue the following command to associate a PowerCell segment with the ELAN you want to join:

`elan-add|eadd` *`<elan-name>`* *`<segment>`* **`[`***`<les-atm-address>`***`]`**

where:

`<elan-name>` Is a name from one to 32 characters in length. You can use alphabetic characters, numerals, and special characters in the name, but you cannot use blank spaces. ELAN names are case-sensitive.

`<segment>` Specifies the segment. Each ELAN name can be assigned to only one PowerCell segment within the same PowerHub system.

`<les-atm-address>`

Specifies the LES (LAN Emulation Server) address of the ELAN you are adding to this segment. If you do not specify the LES address, the PowerCell software will try to get the LES address from the LECS.

Here is an example of how to add an ELAN to the PowerCell module. In this example, an ELAN named “elan1” is added to segment 19.

```
5:PowerHub:atm# elan-add elan1 19
```

(3) If you disables the LEC on the PowerCell module in the first step of this procedure, re-enable the LEC using the **`lec-set`** command. (See Section 3.5.2.3.)

You can add a particular ELAN to only one PowerCell segment and the ELAN name must be unique among the PowerCell segments in the same PowerHub chassis. In addition, the ELAN name you specify must match the ELAN name you configured on the FORE switch.

If you did not configure the LECS, you must specify the LES address when you add the ELAN to the PowerCell module. Here is an example of how to specify the LES address with the **`elan-add`** command.

```
6:PowerHub:atm# elan-add elan1 19 47:0079:0000:0000:0000:0000:0000:00a03e000001:00
```

3.5.2.3 Enabling the PowerCell Module to be a LEC

FORE Systems recommends that you use the **elan-configure** command to add ELANs to the PowerCell module and enable the module to be a LEC. The command eliminates the need to type two commands in order to create and enable an ELAN, and **elan-configure** allows you to add an ELAN without having to disable and then re-enable the LEC on the slot using the **lec-set** command. Do not use the **lec-set** command in conjunction with the **elan-configure** command.

To configure the PowerCell module as a LEC (LAN Emulation Client), issue the following command:

lec-set|lse *<slot>***|all** *<param> <value>*
[*<param> <value>***]**

where:

*<slot>***|all** Specifies the NIM slot that contains the PowerCell module. The PowerCell module runs one instance of the LANE 1.0 LEC. The LEC serves all the LANE 1.0 segments on the module. The NIM slots are labeled on the PowerHub chassis. You also can determine the slot number using the **mgmt showcfg** command.

<param> <value> Specifies the LEC parameter and the value you are assigning to the parameter. You can specify one of the following parameters:

lecs-usage|lu enl|dis [*<lecs-atm-address>***]**

Enables or disables the use of the LECS (LAN Emulation Configuration Server) by the LEC of the specified slot.

If you specify the LECS address, separate each portion of the address with a period (**.**), a colon (**:**), or a hyphen (**-**).

If you do not specify the LECS ATM address, the well-known address is used. If you specify **dis** (disabled), the LECS is not used.

state|s enl|dis

Starts or stops the LEC of the specified slot.

Here is an example of how to enable the PowerCell module to use the LECS and to function as a LEC.

```
6:PowerHub:atm# lec-set 4 lecs-usage enl
7:PowerHub:atm# lec-set 4 state enl
```

In this example, the first command enables the PowerCell module in slot 4 of the PowerHub chassis to use the LECS. The second command enables the PowerCell module as a LEC. (In other words, the command starts the LEC.)

3.5.3 Configuring the LES and BUS on the PowerCell 700

Using the commands described in the following sections, you can configure the LES, the BUS, or a colocated LES/BUS pair on the PowerCell 700.

In addition to the commands described in the following sections, the PowerCell software contains commands for displaying LES and BUS statistics and deleting a LES or BUS. See Section A.4.3 on page 129.

3.5.3.1 Configuring a Colocated LES and BUS

To configure a colocated LES and BUS on the PowerCell 700, issue the following command:

atm les-add|leadd *<elan-name> <slot> <les-SELbyte>*
<bus-SELbyte>

where:

<elan-name> Is the ELAN that the LES, BUS, or LES/BUS pair you are creating will serve. You can specify an alphanumeric name from 1 to 32 characters in length.

<slot> Is the chassis slot that contains the PowerCell 700. The slots are labeled on the PowerHub 7000 chassis. You also can determine the slot number using the **mgmt showcfg** command.

<les-SELbyte> Is the Selector byte of the LES. The Selector byte is the final two hexadecimal digits in an NSAP ATM address. You can specify the hexadecimal digits alone or use “0x” to flag them. In either case, the software assumes that the digits are hexadecimal.

<bus-SELbyte> Is the Selector byte of the BUS. You can specify the hexadecimal digits alone or use “0x” to flag them. In either case, the software assumes that the digits are hexadecimal.

NOTE: Do not specify the full ATM address of the BUS. If you do, the PowerCell software will not create a colocated LES/BUS. If you specify only the Selector byte, the PowerCell software creates a colocated BUS.

Here is an example of this command. In this example, a colocated LES/BUS is added to the PowerCell 700 in slot 1. Because only the Selector byte of the BUS is specified, the PowerCell software assumes you want a colocated LES/BUS and creates one. The LES/BUS will serve the ELAN named “engineering.”

```
4:PowerHub:atm# les-add engineering 1 0x10 0x20
```

3.5.3.2 Configuring a LES

To configure a LES (but not a colocated LES/BUS) on the PowerCell 700, issue the following command:

atm les-add|leadd *<elan-name> <slot> <les-SELbyte>*
<bus-atm-address>

where:

<elan-name> Is the ELAN that the LES, BUS, or LES/BUS pair you are creating will serve. You can specify an alphanumeric name from 1 to 32 characters in length.

<slot> Is the chassis slot that contains the PowerCell 700. The slots are labeled on the PowerHub 7000 chassis. You also can determine the slot number using the **mgmt showcfg** command.

<les-SELbyte> Is the Selector byte of the LES. The Selector byte is the final two hexadecimal digits in an NSAP ATM address. You can specify the hexadecimal digits alone or use “0x” to flag them. In either case, the software assumes that the digits are hexadecimal.

<bus-atm-address>

Is the full NSAP ATM address of the BUS. You must specify the full ATM address when the BUS is on another device. If you specify only the BUS’s Selector byte, the PowerCell software adds a colocated BUS on the PowerCell module.

In the following example, a LES for an ELAN called “marketing” is added to the PowerCell 700 in slot 2. The Selector byte of the LES is 30 (hexadecimal). Because the BUS is on another device, the full ATM address of the BUS is specified. By specifying the ATM address of the BUS, you inform the LES of the location of the BUS in your ATM network.

```
4:PowerHub:atm# les-add marketing 2 0x30 47:0005:80ff:e100:0000:f21a:2c00:0000ef042990:20
```

3.5.3.3 Configuring a BUS

To configure a BUS (but not a colocated LES/BUS) on the PowerCell 700, issue the following command:

atm bus-add|buadd *<elan-name> <slot> <bus-SELbyte>*

where:

<elan-name> Is the name of the ELAN that the BUS will serve. You can specify an alphanumeric name from 1 to 32 characters in length.

<slot> Is the chassis slot that contains the PowerCell 700. The slots are labeled on the PowerHub 7000 chassis. You also can determine the slot number using the **mgmt showcfg** command.

<bus-SELbyte> Is the Selector byte of the BUS. The Selector byte is the final two hexadecimal digits in an NSAP ATM address. You can specify the hexadecimal digits alone or use “0x” to flag them. In either case, the software assumes that the digits are hexadecimal.

Here is an example of this command. In this example, a BUS is added to the PowerCell 700 in slot 1 for an ELAN named “AMGIC-BUS.” The Selector byte for the BUS is 20 (hexadecimal). In this example, the “0x” used to denote a hexadecimal address is omitted. The “0x” is optional.

```
4:PowerHub:atm# bus-add MAGIC-BUS 1 20
```

3.5.3.4 Displaying the LES and BUS Configuration

After you configure a LES, a BUS, or a colocated LES/BUS on the PowerCell 700, you can display the configuration by issuing the following command:

atm service-show|sescf *<elan-name>***|all** *<slot>***|all**
[les|bus]

where:

*<elan-name>***|all**

Is the name of the ELAN that the LES, BUS, or LES/BUS pair serves. If you specify **all**, configuration information about all the LESs, BUSs, and colocated LES/BUSs on the PowerCell 700 in the specified slot is displayed.

*<slot>***|all** Is the chassis slot that contains the PowerCell 700. The slots are labeled on the PowerHub 7000 chassis. You also can determine the slot number using the **mgmt showcfg** command. If you specify **all**, configuration information about all the LESs, BUSs, and colocated LES/BUSs on all PowerCell 700 Modules in the PowerHub chassis is displayed.

les|bus Restricts the display to LESs only or BUSs only.

Here are some examples of the information displayed by this command. In the first example, summary information for all the LES and BUS services configured on the PowerCell 700 in slot 1 is displayed.

```
4:PowerHub:atm# service-show all 1
     Services on slot 1
     Slot  Name              Service Type       SEL
     ----  ----              ------------       ---
     1     engineering       LES                0x10
     1     engineering       BUS                0x20
     1     marketing         LES                0x30
     1     sales             Colocated LES/BUS  0x40
```

The fields in this display show the following information:

`Slot`	Indicates the PowerHub slot that contains the PowerCell 700 on which the listed service is configured.
`Name`	Indicates the name of the ELAN served by the LES or BUS.
`Service Type`	Indicates the service type. The service can be a BUS, a LES, or a colocated LES/BUS.
`SEL`	Indicates the Selector byte of the LES, BUS, or colocated LES/BUS.

In the following example, detailed information for a specific LES (for the ELAN "engineering") is displayed. Detailed information is displayed only when you request information about a specific service. If you request information for more than one service, summary information is displayed.

```
4:PowerHub:atm# service-show engineering 1 les
LES Configuration for: engineering

---------------------------------------------------------------------------
LES ATM Address : 47:0005:80ff:e100:0000:f21a:2d09:0020481a2d09:10
BUS ATM Address : 47:0005:80ff:e100:0000:f21a:2d09:0020481a2d09:10
Proxy Party Count     : 1
Proxy PMP VPI         : 0
Proxy PMP VCI         : 84
Non-Proxy Party Count: 0
Non-Proxy PMP VPI     : 0
Non-Proxy PMP VCI     : 0
```

The fields in this display show the following information:

`LES ATM Address`	Indicates the ATM address of the LES.
`BUS ATM Address`	Indicates the ATM address of the BUS associated with this LES.
`Proxy Party Count`	Indicates how many ATM hosts that are proxies are served by the LES.
`Proxy PMP VPI`	For proxy hosts, shows the PMP (Point-to-Multipoint) VPI (Virtual Path Identifier) the LES is using.
`Proxy PMP VCI`	For proxy hosts, shows the PMP (Point-to-Multipoint) VCI (Virtual Channel Identifier) the LES is using.
`Non-Proxy Party Count`	Indicates how many ATM hosts that are not proxies are served by the LES.
`Non-Proxy PMP VPI`	For non-proxy hosts, shows the PMP (Point-to-Multipoint) VPI (Virtual Path Identifier) the LES is using.

`Non-Proxy PMP VCI`	For non-proxy hosts, shows the PMP (Point-to-Multipoint) VCI (Virtual Channel Identifier) the LES is using.

```
4:PowerHub:atm# service-show eng-BUS 1 bus
BUS Configuration for: eng-BUS

---------------------------------------------------------------------------
BUS ATM Address : 99:9999:9999:9999:9999:9999:9999:0000ef043480:20
BUS PARTY COUNT : 1
BUS PMP VPI     : 0
BUS PMP VCI     : 79
```

The fields in this display show the following information:

`BUS ATM Address`	Indicates the ATM address of the BUS.
`BUS Party Count`	Indicates how many ATM hosts that are proxies are served by the BUS.
`BUS PMP VPI`	Shows the PMP (Point-to-Multipoint) VPI (Virtual Path Identifier) the BUS is using.
`BUS PMP VCI`	Shows the PMP (Point-to-Multipoint) VCI (Virtual Channel Identifier) the BUS is using.

3.5.4 Implementing the Failover Mechanism

To implement the failover mechanism for an ELAN, do the following:

(1) Add the LES/BUS pairs. Up to three LES/BUS pairs to the PowerCell module, ATM switch, or Host where the LES/BUS is to reside. The LES/BUS pairs must contain an ELAN name, a selector byte, and an instance (0, 1, or 2). To differentiate between the LES/BUS pairs for failover, you give each the same ELAN name, but a different selector byte and instance. To assign an instance, you use a vertical bar (**|**) to separate the ELAN name from the LES instance. If you are not using an LECS, you must include the full ATM NSAP address of the LES. To configure a LES/BUS pair on a PowerCell segment, use the **`atm les-add`** command (see Section 3.5.3 on page 71)

(2) Configure the LECS. The LECS must be configured to match the LES/BUS selector bytes and instances for each ELAN. This must be done unless no LECS is to be used in the ELAN, in which case the full ATM NSAP address (and not just selector byte) must be specified in the LES/BUS configuration step. To configure a LECS, see the *ForeRunner ATM Switch Configuration Manual*, or the *ForeRunner SBA-200 ATM SBus Adapter User's Manual*. An example of a LECS configuration is shown in Section 3.6.2 on page 84

(3) Configure the ELAN instances. The ELAN instances must match the names and instances in the steps above. Again, use the same ELAN name with a vertical bar (**|**) to separate the ELAN name from the LES instance. It is not necessary to specify the

selector byte of the LES/BUS pair when configuring the ELAN instances. (To add an ELAN to a PowerCell segment, use the **`atm elan-configure`** command. See Section 3.5.4.2 on page 77.)

For an example of this procedure, see Section 3.6 on page 81.

All three instances of the ELAN name reside on the same PowerCell segment, but only one instance is active.

The PowerHub implementation of the failover mechanism is transparent to PowerHub bridging and routing. The PowerHub bridging and routing software continue to use the same segment number for the ELAN, regardless of the LES instance that is active.

Figure 3–5 shows an example of how the failover mechanism is used on the PowerCell module.

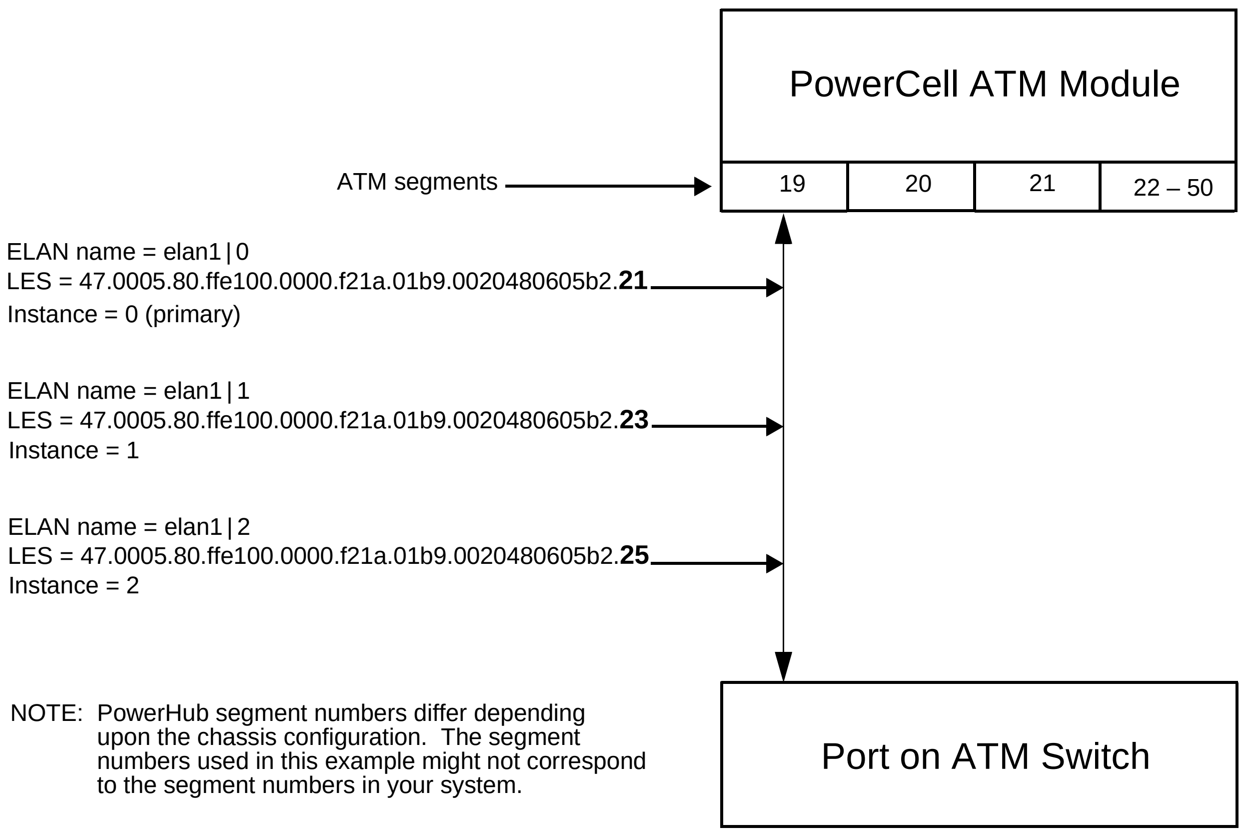


FIGURE 3–5 Failover mechanism on PowerCell module.

In Figure 3–5, three instances of elan1 have been added to PowerCell segment 19 as three distinct ELANs: elan1|0, elan1|1, and elan1|2. A LES address has been specified for each instance, either using the PowerHub **`elan-configure`** command or using entries in the LECS configuration file.

The LESs are distinguished in this example by the Selector bytes (21, 23, and 25). You specify the LES address, including the Selector bytes, when you add an ELAN to a PowerCell segment. You can specify the LES addresses when you add the ELANs to the PowerCell module. However, you do not need to specify the LES addresses on the

PowerCell module if you are using a LECS and have specified the LES addresses (and failover instances) in the LECS configuration file.

In Figure 3–5, LES 21 is the primary LES (instance 0) and is always used unless it fails. If the primary LES fails, the software attempts to use instance 1 of the LES (LES 23 in Figure 3–5). If instance 1 also fails, the software uses instance 2 (LES 25 in Figure 3–5). Note that LES addresses do not in themselves have any hierarchy or priority. You establish a hierarchy among the LES addresses when you associate the addresses with instance numbers.

After the failover mechanism switches to LES instance 1 (the backup LES), the software periodically attempts to re-establish connection to the primary LES (instance 0). When a LES fails or when the failover mechanism attempts to re-establish connection to the primary LES, traffic on the PowerCell module is momentarily interrupted while the software establishes VCs (Virtual Circuits) to the new LES and flushes the LE_ARP, bridge, and route caches on the module.

Use the commands in the following sections to implement the LEC failover mechanism on the PowerCell module. These commands implement the failover feature in the PowerCell module only. To implement the failover mechanism on the ATM switch, see the documentation for your ATM switch.

3.5.4.1 Preparing the LECS for the Failover Mechanism

Before adding the ELAN to the PowerCell segments, add the desired LES/BUS pairs to the PowerCell segment and implement the failover mechanism in the LECS configuration file. Use the **`atm les-add`** command to configure the LES/BUS pairs (see Section 3.5.3 on page 71). See the *ForeRunner ATM Switch Configuration Manual*, or the *ForeRunner SBA-200 ATM SBus Adapter User's Manual* for information on configuring the LECS.

3.5.4.2 Preparing the PowerCell Module for the Failover Mechanism

Preparing the failover mechanism using `elan-configure` the command

If you are using the **`elan-configure`** command, configuring the LEC failover mechanism is a one-step process. To configure the LEC failover mechanism, add up to three instances of the elan using the **`elan-configure`** command as follows:

`elan-configure` <*elan-name*> <*segment*> **`state|s enl`**

where:

<elan-name>	Is a name from one to 32 characters in length. You can use alphabetic characters, numerals, and special characters in the name, but you cannot use blank spaces. ELAN names are case-sensitive. To configure the ELAN to use the LEC failover mechanism, use a vertical bar (**|**) to separate the ELAN name from the LES instance number (0, 1, or 2). Then enclose the ELAN name and the instance number in double quotes (**`" "`**). Example: `"elan1|0"`. The primary LES instance is 0. Issue a separate **`elan-add`** command for each instance of the LES (see the command example on the next page). Make sure you use the same ELAN name for each instance of the LES.

<segment> Specifies the segment. Each ELAN name can be assigned to only one PowerCell segment within the same PowerHub system.

<les-atm-address>

Specifies the LES address of the ELAN you are adding to this segment.

Here is an example of the commands used to configure elan1 in Figure 3–5. Notice that separate commands are used for each instance of the LES.

```
1:PowerHub:atm# elan-configure "elan1|0" 19

2:PowerHub:atm# elan-configure "elan1|1" 19

3:PowerHub:atm# elan-configure "elan1|2" 19
```

Notice that the LES addresses are not specified. The PowerHub software determines the LES address for an instance based upon the address associated with that instance in the LECS configuration file. The software assumes that you want to use the LES address associated with instance 0 in the LECS configuration file as the LES address for instance 0, and so on.

If you specify the LES addresses when you add the ELAN instances to the PowerCell segment, make sure the addresses match the addresses you specified in the LECS configuration file.

Preparing the failover mechanism using `elan-add` and `lec-set` the commands

If you used the **`elan-configure`** command to add the three instances of your ELAN, skip this section and go to Section 3.5.5 on page 80.

If you use the **`elan-add`** and **`lec-set`** commands to configure the PowerCell module, it is a three step process.

> **NOTE**: If you have used the **`elan-configure`** command to add ELANs, do not use the **`elan-add`** and **`lec-set`** commands. Instead, use the **`elan-configure`** command.

To configure the LEC failover mechanism, do the following:

(1) If you previously enabled the LEC on the PowerCell module, disable it by issuing the following command:

`lec-set|lse` *`<slot>`***`|all lecs-usage dis state dis`**

where:

*<slot>***|all** Specifies the slot that contains the PowerCell module.

- On the PowerHub 7000, the slots are labeled on the PowerHub chassis.

- On the PowerHub 6000, the PowerCell 600 is always in slot 2.

On both PowerHub models, you also can determine the slot number using the **mgmt showcfg** command.

(2) To configure an ELAN to use the failover mechanism, issue the following command to add the ELAN. You need to issue a separate command for each LES:

elan-add|eadd *<elan-name> <segment>* **[***<les-atm-address>***]**

where:

<elan-name> Is a name from one to 32 characters in length. You can use alphabetic characters, numerals, and special characters in the name, but you cannot use blank spaces. ELAN names are case-sensitive.

To configure the ELAN to use the LEC failover mechanism, use a vertical bar (**|**) to separate the ELAN name from the LES instance number (0, 1, or 2). Then enclose the ELAN name and the instance number in double quotes (**" "**). Example: "elan1|0". The primary LES instance is 0. Issue a separate **elan-add** command for each instance of the LES (see the command example on the next page). Make sure you use the same ELAN name for each instance of the LES.

<segment> Specifies the segment. Each ELAN name can be assigned to only one PowerCell segment within the same PowerHub system.

<les-atm-address>

Specifies the LES address of the ELAN you are adding to this segment.

Here is an example of the commands used to configure elan1 in Figure 3–5. Notice that separate commands are used for each instance of the LES.

```
1:PowerHub:atm# elan-add "elan1|0" 19

2:PowerHub:atm# elan-add "elan1|1" 19

3:PowerHub:atm# elan-add "elan1|2" 19
```

Notice that the LES addresses are not specified. The PowerHub software determines the LES address for an instance based upon the address associated with that instance in the LECS configuration file. The software assumes that you want to use the LES address associated with instance 0 in the LECS configuration file as the LES address for instance 0, and so on.

If you specify the LES addresses when you add the ELAN instances to the PowerCell segment, make sure the addresses match the addresses you specified in the LECS configuration file.

(3) Enable (or re-enable) the LEC on the PowerCell module by issuing the **lec-set** command. The syntax is the same as shown in step 1, only you use the **enl** value instead of the **dis** value for the **lec-set** and the **state** parameters.

3.5.4.3 Determining Which LES and BUS Are in Use

At any time, you can determine which LES and BUS an ELAN is using by issuing the **elan-showcfg all** command. (See Section A.4.3.19 on page 146).

3.5.5 Verifying the PowerCell LANE 1.0 Configuration

After you configure the PowerCell module as a LEC, the LEC software on the module serves all the ATM segments on that module that you have configured for LANE 1.0. To display configuration information for the PowerCell module, issue the following command:

lec-showcfg|lscf *<slot>***|all**

where:

*<slot>***|all** Specifies the slot that contains the PowerCell module.

- On the PowerHub 7000, the slots are labeled on the PowerHub chassis.
- On the PowerHub 6000, the PowerCell 600 is always in slot 2.

On both PowerHub models, you also can determine the slot number using the **mgmt showcfg** command.

If you specify **all**, the LEC configuration for all the PowerHub modules in the chassis is displayed.

Here is an example of the information displayed by this command. The “LE Client” is the LEC (PowerCell module).

```
8:PowerHub:atm# lec-showcfg 4
LEC Configuration For slot: 4
--------------------------------------------------------------------------
LE Client State       : Enabled
LE Client ATM Address : 47:0005:80ff:e100:0000:f21a:1e3c:0000ef0282d0:00
LECS ATM Address      : 47:0079:0000:0000:0000:0000:0000:00a03e000001:00
```

The fields in this display show the following information:

LE Client State	Indicates whether the PowerCell module is enabled as a LEC (LAN Emulation Client).
LE Client ATM Address	Indicates the ATM address of the PowerCell module. The address displayed is the base address of the LEC (PowerCell module). The Selector byte contains zeroes (00). Each ELAN configured on the PowerCell module uses the base address but has a unique value in the Selector byte.
LECS ATM Address	Indicates the ATM address of the LECS (LAN Emulation Configuration Server).

3.5.6 Verifying PowerCell LANE 1.0 Operation

After you set configuration parameters for an ELAN, you can verify the parameters by issuing the **elan-showcfg** command:

elan-showcfg|escf *<elan-name>***|all**

where:

*<elan-name>***|all** Specifies the name of the ELAN for which you want to display ELAN parameters. If you specify **all**, the parameters you configure are applied to all the ELANs in the PowerHub system.

Here is an example of the information displayed by this command. In this example, configuration information is displayed for an ELAN named “elan1.”

```
9:PowerHub:atm# elan-showcfg elan1
Configuration For ELAN: elan1

---------------------------------------------------------------------------
Segment        :    19
Max ARP Retry  :     2
ARP Aging Time :   300 (sec)
Control Timeout:   120 (sec)
Flush Timeout  :     6 (sec)
Forward Delay  :    15 (sec)
VCC Timeout    :    20 (min)
BUS Rate       :     0 (pps)

LES Address    : 47:0005:80ff:e100:0000:f21a:1e3c:0020481a1e3c:01
BUS Address    : 47:0005:80ff:e100:0000:f21a:1e3c:0020481a1e3c:02
```

In addition to the LES address and BUS address, this command displays the settings for various ATM parameters. For information about the parameters shown by this command, see the corresponding descriptions for the **elan-set** command (Section A.4.3.20 on page 149).

3.6 LANE 1.0 CONFIGURATION EXAMPLES

Depending upon your ATM hardware and software, these items can be configured on the ATM switch, on a workstation, or might be distributed between the ATM switch and a workstation. For example, you might install the LECS on a Sun workstation and the LES and BUS on the FORE switch, as shown in Figure 3–6.

> **NOTE**: In software version 7-2.6.4.0 and later, you can configure the LES and BUS on the PowerCell 700. This example shows the LES and BUS configured on the ATM switch.

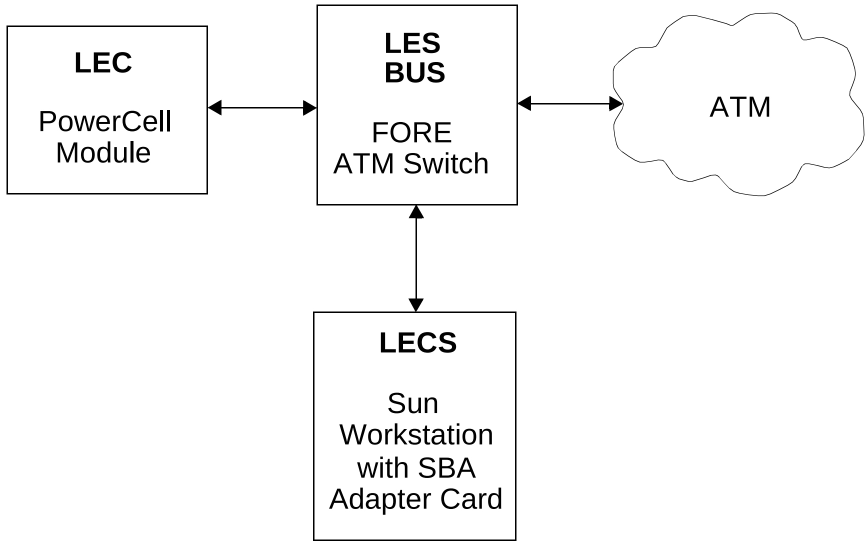


FIGURE 3–6 Example LANE 1.0 Configuration.

Table 3–1 lists the hardware used for each LANE 1.0 component shown in Figure 3–6.

TABLE 3–1 LANE 1.0 components.

LANE 1.0 Component	Hardware	Software
LEC	PowerCell module	ELAN names. Each ELAN is associated with an ATM segment. If no LECS is configured, the ATM address of the LES is specified with each ELAN name.
LES and BUS	ASX-200BX ATM Switch	ATM addresses of the LES and BUS. In this example, the LES and BUS are *colocated* (located on the same machine).
LECS	SBA-200 ATM Adapter Card (installed on Sun workstation)	LECS configuration file. Contains the ATM addresses of the ELANs. Also contains filters for accepting or discarding specific ATM addresses.

NOTE: If a LECS is unavailable or you cannot add a LECS, you can still use ELANs if you supply the LES address when you add the ELANs. (See Section 3.5.2.2 on page 68.)

3.6.1 LES and BUS Example (ASX-200BX ATM Switch)

Here is an example of the commands you would issue on the FORE switch to configure the LES and BUS. In this configuration, the LES and BUS are colocated, and elan1 is configured to use the LECS failover mechanism.

```
localhost::configuration lane les> new 0x21 0x22 elan1|0 colocated_bus

fore-lane-le-20002: LES for "elan1|0" on 47.0005.80.ffe100.0000.f21a.218e.0020481a218e.21
fore-lane-le-20003: BUS for "elan1|0" on 47.0005.80.ffe100.0000.f21a.218e.0020481a218e.22

localhost::configuration lane les> new 0x23 0x24 elan1|1 colocated_bus

fore-lane-le-20002: LES for "elan1|1" on 47.0005.80.ffe100.0000.f21a.218e.0020481a218e.23
fore-lane-le-20003: BUS for "elan1|1" on 47.0005.80.ffe100.0000.f21a.218e.0020481a218e.24

localhost::configuration lane les> new 0x25 0x26 elan1|2 colocated_bus

fore-lane-le-20002: LES for "elan1|2" on 47.0005.80.ffe100.0000.f21a.218e.0020481a218e.25
fore-lane-le-20003: BUS for "elan1|2" on 47.0005.80.ffe100.0000.f21a.218e.0020481a218e.26

localhost::configuration lane les> new 0x03 0x04 elan2 colocated_bus

fore-lane-le-20004: LES for "elan2" on 47.0005.80.ffe100.0000.f21a.218e.0020481a218e.03
fore-lane-le-20005: BUS for "elan2" on 47.0005.80.ffe100.0000.f21a.218e.0020481a218e.04
```

When you add ELANs to the segments on the PowerCell module, make sure you use the ELAN names you configured on the LECS, LES, and BUS. Note that you must alter the `lecs.cfg` file to reflect any configuration changes you make adding or deleting ELANs and LES/BUS instances. See the *ForeRunner ATM Switch Configuration Manual* for more information on the `lecs.cfg` file.

3.6.2 LECS Example (SBA-200 ATM Adapter Card)

Here is an example of the LECS configuration file on the Sun workstation in Figure 3–6.

```
#
# The search ordering of ELAN names
#
#
# Parameters for the default ELAN
#
Match.Ordering: elan1|0, elan1|1, elan1|2, elan2

elan1|0.Address: 47000580ffe1000000f21a218e0020481a218e21
elan1|0.Accept:  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

elan1|1.Address: 47000580ffe1000000f21a218e0020481a218e23
elan1|1.Accept:  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

elan1|2.Address: 47000580ffe1000000f21a218e0020481a218e25
elan1|2.Accept:  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

elan2.Address: 47000580ffe1000000f21a218e0020481a218e03
elan2.Accept:  XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

The LECS configuration file in this example lists the ATM addresses for two ELANs, elan1 and elan2. The first ELAN, elan 1, has been configured for the LECS failover mechanism by having three instances of the same elan configured with different selector bytes. The “accept” filter listed under each ELAN ATM address specifies the LECs that can access the ELAN. In this example, all ATM addresses are allowed to access the ELANs.

3.6.3 LEC Example (PowerCell 700)

Here is an example of the PowerHub commands you issue to configure the segments on the PowerCell module. The commands in the following example configure segments 19 and 20 to use LANE 1.0. In this example, the terse form of the atm **`segment-set`** command is used.

```
17:PowerHub:atm# sse 19 p lane

18:PowerHub:atm# sse 20 p lane
```

Before the segments can begin switching in the LANE 1.0 environment, you must add an ELAN to each segment, as shown in the following example. The terse form of the **`elan-configure`** command is used.

```
13:PowerHub:atm# elco elan1|0 19

14:PowerHub:atm# elco elan1|1 19

15:PowerHub:atm# elco elan1|2 19

16:PowerHub:atm# elco elan2 20
```

When you add the ELANs to the segment using the **`elan-configure`** command, the ELAN is automatically enabled to get information from the LECS and the LEC software is started on the PowerCell module.

If you choose to configure the LEC on the PowerCell module using the **`elan-add`** and **`lec-set`** commands, it is a three or four step process. However, you should not use this method if you have previously used the **`elan-configure`** command to configure segments.

```
17:PowerHub:atm# sse 19 p lane

18:PowerHub:atm# sse 20 p lane
```

To add an ELAN using the **`elan-add`** and **`lec-set`** commands:

(1) Disable the LEC software on the PowerCell module using the **`lec-set`** command with the **`lecs-usage`** and **`state`** parameters set to **`enl`**. (See Section 3.5.2.3 on page 70 for information on the **`lec-set`** command.)

(2) Add the segment using the **`elan-add`** command. (see Section 3.5.2.2 on page 68 for information on the **`elan-add`** command)

(3) Enable the PowerCell module to get information from the LECS using the **`lec-set`** command with the **`lec-usage`** parameter. (See Section 3.5.2.3 on page 70 for information on the **`lec-set`** command.)

(4) Start the LEC software on the PowerCell module using the **`lec-set`** command with the **`lecs-usage`** and **`state`** parameters set to **`enl`**. (See Section 3.5.2.3 on page 70 for information on the **`lec-set`** command.)

4 RFC-1483 Encapsulation over PVC

This chapter describes the PowerHub support for RFC-1483 Encapsulation over PVC (hereafter called RFC-1483 Encapsulation). *RFC-1483 Encapsulation* provides a simple mechanism for encapsulating bridged and routed packets.

> **NOTE**: RFC-1483 Encapsulation is not supported on the PowerCell 600.

Use RFC-1483 Encapsulation if you need to connect the PowerHub system to an ATM backbone. RFC-1483 requires fewer configuration steps than LANE 1.0, Classical IP over ATM, and FORE IP.

Note that RFC-1483 Encapsulation does not provide ARP services or broadcast/multicast services. Consequently, if your network is dynamic and requires these services, you might want to use LANE 1.0, Classical IP, or FORE IP instead of RFC-1483 Encapsulation.

This chapter shows how a PowerCell module configured for RFC-1483 Encapsulation fits into your ATM network and describes how to configure a PowerCell segment for RFC-1483 Encapsulation.

4.1 THE POWERCELL MODULE AND RFC-1483 ENCAPSULATION

When you configure a PowerCell segment for RFC-1483 Encapsulation, you configure a PVC between the PowerCell segment and the ATM switch to which the PowerCell module is connected. To configure the PVC, you assign an incoming VCI (Virtual Circuit ID) and an outgoing VCI to the segment. The VCs are unidirectional; therefore the number you assign to the incoming VCI on a particular segment must be different from the number you assign to the outgoing VCI on that same segment.

Figure 4–1 shows an example of a connection between a PowerCell module and an ATM network using RFC-1483 Encapsulation.

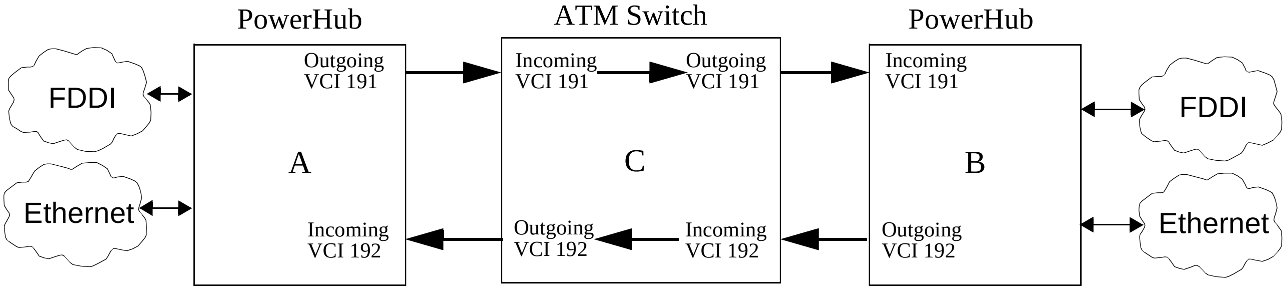


FIGURE 4–1 PowerCell modules connected in ATM Network using RFC-1483 Encapsulation

For each PowerCell segment using RFC-1483 Encapsulation, you configure an incoming VCI and an outgoing VCI on the ATM switch and on the PowerCell module to which the ATM switch is attached. The incoming VCI number on the PowerCell segment must match the outgoing VCI on the ATM switch's port. Likewise, the outgoing VCI number on the PowerCell segment must match the incoming VCI on the ATM switch's port.

In this example, VCI 191 is an outgoing VCI on the PowerCell module of PowerHub "A", the incoming VCI on the one port of ATM switch "C", the outgoing VCI on a different port of ATM switch "C", and an incoming VCI on the PowerCell module of PowerHub "B". VCI 192 follows a similar path in the other direction, using the same ports. In the example, two PVCs make each unidirectional connection between the PowerHub systems; the PVC from PowerHub "A" to ATM switch "C", and the PVC from ATM switch "C" to PowerHub "B" form the first connection, and the second is formed in the other direction.

By configuring incoming and outgoing VCIs between the PowerCell modules and the ATM switch, you allow the PowerHub systems and the ATM switch to bridge and route traffic between the ATM network and your Ethernet and FDDI LANs.

You can configure one RFC-1483 Encapsulation PVC on each PowerCell segment. The PowerCell module supports up to 32 virtual segments, all of which can be allocated to RFC-1483 Encapsulation PVCs if no other protocols are assigned.

4.2 CONFIGURING A POWERCELL SEGMENT FOR RFC-1483

To use the PowerCell module for RFC-1483 Encapsulation, you must perform the following configuration tasks:

- Configure a PowerCell segment to use RFC-1483 Encapsulation (**`segment-set`** command; see Section 2.10.1 on page 44).
- Enable RFC-1483 Encapsulation on the segment (**`br-encap-set`** command; see Section 4.2.2).

- Verify the RFC-1483 Encapsulation configuration and operation (**`br-encap-showcfg`** command; see Section 4.2.3 on page 91).

The following sections describe how to perform these tasks. See Section 4.2.5 on page 94 for an example of how to configure the PowerCell module and a FORE Systems ATM switch for RFC-1483 Encapsulation.

4.2.1 Configuration Considerations

Before you begin configuring the PowerCell module for RFC-1483 Encapsulation, make sure your configuration plans are not affected by the following considerations:

- The PowerHub implementation of RFC-1483 Encapsulation allows connections only using PVCs (Permanent Virtual Circuits). You must specify the VCIs for a PowerCell segment when you configure the segment for RFC-1483 Encapsulation.
- VC-based multiplexing (described in Section 5 of RFC 1483) is not supported.
- All outgoing packets (packets sent from the PowerCell module to the ATM switch) are sent with the CRC stripped (PID: 0x0007).
- The PowerCell module accepts only PDUs that use Ethernet/802.3 encapsulation. All other PDUs are discarded by the PowerCell module.
- The segment must be configured to use PVS Bridging before RFC-1483 Encapsulation can be enabled. If there are any other protocols configured on the segment, such as FORE IP or LANE, they must first be deleted.

4.2.2 Enabling RFC-1483 Encapsulation on a Segment

Before enabling RFC-1483 Encapsulation on a segment, you must first configure the PowerCell segment to use PVC Bridging using the **`atm segment-set`** command. (See Section 2.10.1 on page 44 for more information on the **`atm segment-set`** command.) To configure the PowerCell segment to use PVC Bridging, telnet into the PowerHub or connect to the PowerHub through the TTY interface, change to the **atm** subsystem, and configure the desired segment.

> **NOTE**: When accessed from within a subsystem, commands do not need to contain the subsystem prefix. Thus, the **`atm segment-set`** command can be used from within the **`atm`** subsystem by typing **`segment-set`**. All commands in this manual issued on the PowerHub system are located in the **atm** subsystem unless otherwise noted.

```
17:PowerHub:atm#segment-set 15 p b
```

The above command configures segment 15 to use PVC Bridging.

After you have enabled PVC Bridging on a PowerCell Segment, you can then enable RFC-1483 Encapsulation on the segment.

To enable RFC-1483 Encapsulation on a PowerCell segment, issue the following command:

atm br-encap-set|bse *<segment>* **[***<param> <value>*
<param> <value>...**] state|s enl|dis**

where:

<segment> Specifies the PowerCell segment on which you are enabling RFC-1483 Encapsulation.

<param> <value> Specifies the RFC-1483 Encapsulation parameter and the value you are assigning to the parameter. You can specify the following parameter:

in-pvc|ip *<vci>*

Specifies the incoming PVC's VCI (Virtual Circuit ID).

out-pvc|op *<vci>*

Specifies the outgoing PVC's VCI (Virtual Circuit ID).

state|s enl|dis

The **state** parameter enables or disables PVC Bridging on the segment you specified. The default is **dis** (disabled).

Here is an example of this command. The command configures PowerHub segment 22 to use PVC 182 as an incoming PVC, PVC 181 as an outgoing PVC, and enables RFC-1483 Encapsulation on the segment.

```
10:PowerHub:atm# br-encap-set 22 ip 182 op 181 state enl
Okay
```

You must use the **in-pvc** and **out-pvc** parameters when you enable RFC-1483 Encapsulation on the segment using the **br-encap-set** command. However, only the segment number and state parameters are needed when you disable RFC-1483 Encapsulation on the segment. When a segment is disabled, both incoming and outgoing VCIs are automatically deleted from the segment.

Here is an example of the command to disable RFC-1483 Encapsulation on the segment that was enabled in the previous example.

```
10:PowerHub:atm# br-encap-set 22 state dis
Okay
```

4.2.3 Verifying PowerCell RFC-1483 Encapsulation Configuration and Operation

You can display the incoming and outgoing VCI (Virtual Channel IDs) and packet statistics for a PowerCell segment that is enabled for RFC-1483 Encapsulation. To display the RFC-1483 Encapsulation information for a segment, issue the following command:

atm br-encap-showcfg|bscf *<segment>***|all**

where:

*<segment>***|all**	Specifies the PowerCell segment(s) for which you want to display the PVC configuration and statistics. You can specify a single segment number or all segments. If you specify **`all`**, PVC information is displayed for all the PowerCell segments in the chassis on which RFC-1483 Encapsulation is enabled.

Here is an example of this command. In this example, PVC information is displayed for segment 25.

```
12:PowerHub:atm# br-encap-showcfg 25
RFC-1483 encapsulation information for segment 25
    In PVC VCI:                      182
    Out PVC VCI:                     181

    Total Pkts sent:                 25
    Total Pkts rcvd:                 322
    Pkts rcvd with unknown type:     0
    Pkts rcvd with unknown protocol: 0
    Pkts rcvd with length too big:   0
```

The fields in this display show the following information:

`In PVC VCI`	The incoming PVC's VCI. You specify this value when you configure a PowerCell segment for RFC 1483 (using the **`in-pvc`** argument of the **`br-encap-set`** command).
`Out PVC VCI`	The outgoing PVC's VCI. You specify this value when you configure a PowerCell segment for RFC 1483 (using the **`out-pvc`** argument of the **`br-encap-set`** command).
`Total Pkts sent`	The number of packets sent on this segment's outgoing PVC. The PowerCell module begins accumulating these statistics when RFC-1483 encapsulation on a segment is enabled.
`Total Pkts rcvd`	The number of packets received on this segment's incoming PVC. The PowerCell module begins accumulating these statistics when RFC-1483 encapsulation on a segment is enabled.

`Pkts rcvd with unknown type`

The number of packets received on this segment's incoming PVC with an unknown type. Any packet that does not contain a SNAP header and an OID of 008002 is considered a packet of unknown type.

`Pkts rcvd with unknown protocol`

The number of non-RFC1483 packets received on this segment's incoming PVC.

`Pkts rcvd with length too big`

The number of packets received on this segment's PVC with a packet length that is too big. Any packet that exceeds the maximum ethernet packet length of 1518 bytes is considered too big and is dropped.

After you display the RFC-1483 Encapsulation information, do the following to verify that RFC-1483 Encapsulation is operational on the PowerCell module:

(1) Check the `In PVC VCI` and `Out PVC VCI` fields to make sure they contain the VCIs you expect.

(2) Place the segment in a live network (if you have not already done so), then re-issue the **`br-encap-showcfg`** command to refresh the display.[1] Check the `Total Pkts sent` and `Total Pkts rcvd` fields for signs of activity. If these fields contain zeroes or the other fields indicate errors:

(a) Reboot the system.

(b) Check the RFC-1483 Encapsulation configuration on the PowerCell module and on the other ATM hardware.

(c) Allow the PowerCell module to operate in your ATM network for a few moments.

(d) Refresh the RFC-1483 Encapsulation display.

(e) If the PowerCell module and ATM switch are properly configured but the RFC-1483 Encapsulation display still shows no packet activity or shows errors, contact FORE Systems TAC (Technical Assistance Center).

(f) Test the PVC by pinging across the PVC from one endstation to another. The commands you use to ping depend upon the type of workstation you are using as the endstation.

1. See Section A.4.4.2 on page 151 for information about the fields in the RFC-1483 Encapsulation display.

4.2.4 Removing an RFC-483 Encapsulation from a segment

Before you can use another protocol on a segment configured for RFC-1483 Encapsulation, the current protocol must be disabled and then removed from the segment. If this is not done, the segment will not be available to run any other protocol.

To disable the segment, issue the **`br-encap-set`** command. Here is an example of the command. In this example, the terse form of the command is used.

```
10:PowerHub:atm# bse 22 s dis
Okay
```

In the above example, RFC-1483 Encapsulation was disabled on segment 22. To verify that the command was successful, you can issue the **`br-encap-showcfg`** command for that segment. See Section 4.2.3 for more information on the **`br-encap-showcfg`** command.

After you disable the segment, use the **`segment-set`** command to remove the protocol from the segment. Here is an example of the **`segment-set`** command. In this example, the terse form of the command is used.

```
10:PowerHub:atm# sse 22 p n
Okay
```

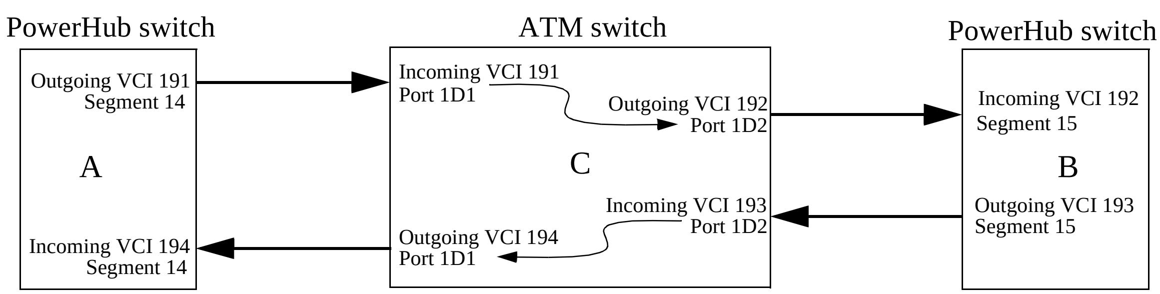
In the above example, the RFC-1483 Encapsulation was removed from segment 22. To verify that the command was successful, you can issue the **`segment-showcfg`** command. See Section 2.10.2 on page 45 for more information on the **`segment-showcfg`** command.

The segment is now available and can be configured for use by another protocol.

4.2.5 RFC-1483 Encapsulation Configuration Example

The following sections show the commands that you would issue on the ATM switch and the PowerCell modules to create the configuration shown in Figure 4–2. This configuration sets up PVCs from PowerHub “A” to PowerHub “B” through a FORE ATM Switch “C”. Because PVCs are unidirectional, PVCs must also be set in the reverse direction, from PowerHub “B” to PowerHub “A” through the FORE ATM Switch “C.”

Note that each link between the PowerHub and the FORE ATM Switch is an independent PVC, and so the same VCI number can be used the full length of the connection as long as the FORE ATM Switch is configured to map the VCIs through the correct ports. In this example, different VCIs are used in each PVC to create the connections: VCI 191 is used for the PVC between PowerHub “A” and FORE ATM Switch “C”, and VCI 192 is used for the PVC between FORE ATM Switch “C” and PowerHub “B”. In the other direction, VCI 193 is used for the PVC between PowerHub “B” and FORE ATM Switch “C”, and VCI 194 is used for the PVC between FORE ATM Switch “C” and PowerHub “A”



PowerHub "A" PowerCell Configuration	ATM Switch "C" Configuration		PowerHub "B" PowerCell Configuration
Segment 14	Port 1D1	Port 1D2	Segment 15
Outgoing VCI 191	Incoming VCI 191	Outgoing VCI 192	Incoming VCI 192
Incoming VCI 194	Outgoing VCI 194	Incoming VCI 193	Outgoing VCI 193

FIGURE 4–2 RFC-1483 Encapsulation Configuration Example

Note also that all commands must be issued from a management session on the hub or switch that is being configured.

4.2.5.1 FORE ATM Switch "C"

Here is an example of the commands you would issue in the FORE ATM switch to configure the PVCs on the ATM switch to match the configuration shown above. The first command in this example configures the PVC from port 1D1 to port 1D2. The second command sets up the PVC in the reverse direction, from port 1D2 to port 1D1.

```
localhost::configuration> vcc new 1D1 0 191 1D2 0 192

localhost::configuration> vcc new 1D2 0 193 1D1 0 194
```

NOTE: On the ATM switch, do not type the name of the subsystem with the command if you are already in the subsystem. The example below shows two ways to issue the same command. The first issues the command from within the `vcc` subsystem, and the second issued the same command from outside the `vcc` subsystem.

```
localhost::configuration vcc> new 1D1 0 191 1D2 0 192

localhost::configuration> vcc new 1D1 0 191 1D2 0 192
```

4.2.5.2 PowerCell Module on PowerHub "A"

Here is an example of the PowerHub commands you issue to configure the segment on the PowerCell module for RFC-1483 Encapsulation. These examples show how to create the configuration shown in Figure 4–2 on page 94.

The **`segment-set`** command in the following example configures PowerCell segment 14 on PowerHub “A” to use RFC-1483 Encapsulation.

```
13:PowerHub_A:atm# segment-set 14 p bridge-encap
```

Before segment 14 can begin switching traffic between the ATM network and Ethernet and FDDI, you must use the **`br-encap-set`** command to enable RFC-1483 Encapsulation on the segment and configure the incoming and outgoing VCIs. Note that the incoming VCI number on the PowerCell segment must match the outgoing VCI number configured on the ATM switch. Likewise the outgoing VCI number on the PowerCell segment must match the incoming VCI number configured on the ATM switch.

```
14:PowerHub_A:atm# br-encap-set 14 ip 194 op 191 s enl
```

After you configure the VCIs and enable the segment for RFC-1483 Encapsulation, you can verify the configuration and display packet statistics using the **`br-encap-showcfg`** command, as shown in the following example.

```
15:PowerHub_A:atm# br-encap-showcfg 14

RFC-1483 encapsulation information for segment 21
    In PVC VCI:                      194
    Out PVC VCI:                     191

    Total Pkts sent:                 25
    Total Pkts rcvd:                 322
    Pkts rcvd with unknown type:     0
    Pkts rcvd with unknown protocol: 0
    Pkts rcvd with length too big:   0
```

4.2.5.3 PowerCell Module on PowerHub "B"

You repeat the process used to configure PowerHub “A” for the PowerCell Module in PowerHub “B”. Use the same commands and use the VCI numbers that match the port numbers configured on the ATM switch that are connected to PowerHub “B”. For the example in Figure 4–2 on page 94, the **`segment-set`** command would be as follows:

```
13:PowerHub_B:atm# segment-set 15 p bridge-encap
```

Then issue the **`br-encap-set`** command to enable RFC-1483 Encapsulation on the segment and configure the VCIs. Note that the incoming VCI number on the PowerCell segment must match the outgoing VCI number configured on the ATM switch. Likewise the outgoing VCI number on the PowerCell segment must match the incoming VCI number configured on the ATM switch.

```
14:PowerHub_B:atm# br-encap-set 15 ip 192 op 193 s enl
```

After you configure the VCIs and enable the segment for RFC-1483 Encapsulation, you can verify the configuration and display packet statistics using the **br-encap-showcfg** command, as shown in the following example.

```
15:PowerHub_B:atm# br-encap-showcfg 15

RFC-1483 encapsulation information for segment 21
    In PVC VCI:                       192
    Out PVC VCI:                      193

    Total Pkts sent:                  34
    Total Pkts rcvd:                  652
    Pkts rcvd with unknown type:      0
    Pkts rcvd with unknown protocol: 0
    Pkts rcvd with length too big:    0
```

4.2.5.4 Selecting VCIs

Because each connection through an ATM switch is made up of multiple independent PVCs, the same VCI numbers can be used along a single, unidirectional connection from one switch, hub, or client to another. In the example shown in Figure 4–2 on page 94, two different VCIs were used for the individual PVCs in each unidirectional connection between the two PowerHubs. However, you can use the same VCI number along the length of a connection. Using the same VCI for the length of a connection simplifies configuration and management of VCIs, PVCs, and connections. Figure 4–3 shows the same physical configuration as Figure 4–2 on page 94, but uses the same VCI number along the length of the connection. VCI 191 is used for both PVCs from PowerHub "A" to PowerHub "B", and VCI 192 is used for both PVCs from PowerHub "B" back to PowerHub "A".

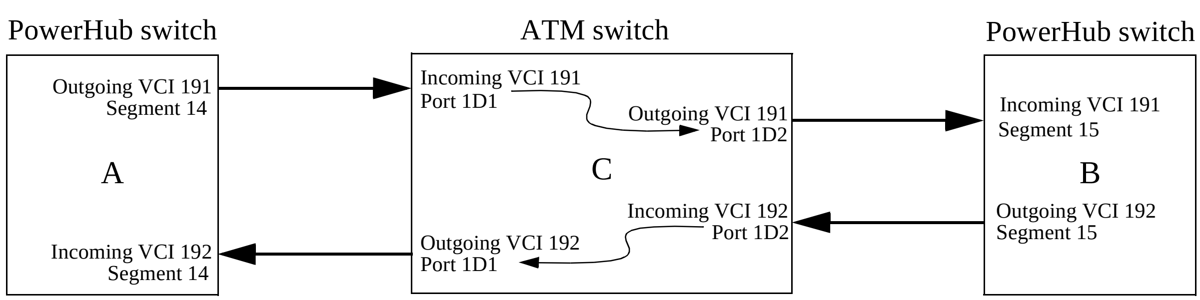


FIGURE 4–3 RFC-1483 Encapsulation example with limited VCI numbers

5 Classical IP over ATM

CLIP (Classical IP over ATM) is an ATM Forum standard that lets you transmit IP datagrams and ARP (Address Resolution Protocol) requests and replies over ATM using AAL5 (ATM Adaptation Layer 5). CLIP is described in RFC 1577.

> **NOTE**: The PowerHub implementation of CLIP does not include support for PVCs (Permanent Virtual Circuits).

> **NOTE**: CLIP is not supported on the PowerCell 600.

This chapter describes the PowerHub support for CLIP.

5.1 THE POWERCELL MODULE AND CLIP

CLIP networks contain the following components:

LIS (Logical IP Subnet) — A group of IP hosts or routers that are directly attached to an ATM switch and have the same IP network address, subnet address, and subnet mask. You can configure one LIS on each PowerCell segment you use for CLIP. After the CLIP network is initialized, individual members of the LIS are joined directly to other members by VCs (Virtual Channels). Hosts that are not members of the LIS can be reached only by using a LAN router (such as the PowerHub 7000).

ATM ARP server — A device that can translate IP addresses into ATM addresses. When the ATM ARP server receives an ARP request from a host in an LIS, the ATM ARP server looks up the IP address supplied in the ARP request and returns the ATM address.

The virtual interfaces that are created in CLIP are based on IP and ATM addresses. The interfaces do not use MAC addresses to resolve destinations or routes. Because of this, all packets must be routed, not bridged, when destined for any other interfaces on the PowerHub switch, including another LIS on the same PowerCell module.

Figure 5–1 shows an example of an ATM network using CLIP. Notice that each ATM host is a member of an LIS. In this example, the hosts are grouped into two LISs: 147.128.10.x and 147.128.20.x.

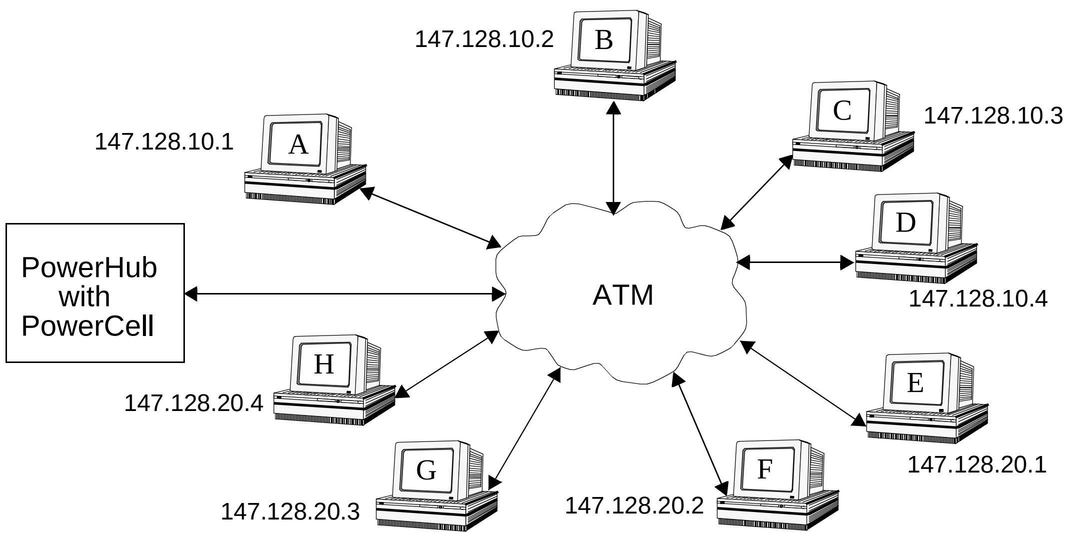


FIGURE 5–1 CLIP network.

Figure 5–2 shows the same network from the PowerHub system’s perspective. Each LIS is associated with its own PowerCell segment.

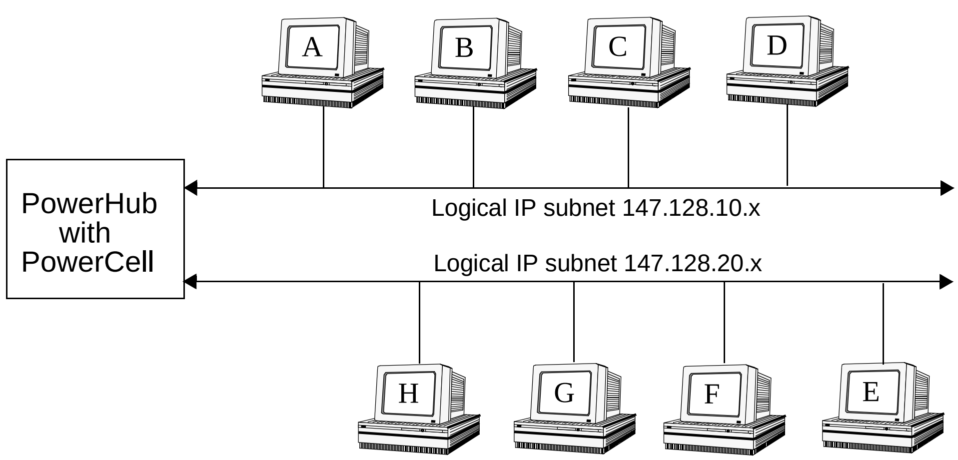


FIGURE 5–2 CLIP network containing LISs—PowerHub view.

Figure 5–1 and Figure 5–2 show two LISs connected to a PowerCell module, which is installed in a PowerHub system. Without a router to connect the LISs, the LISs cannot communicate with each other. The PowerCell module enables the LISs to communicate by routing IP traffic between the LISs.

5.1.1 SVC Support and Packet Encapsulation

The PowerCell module establishes connections between members of an LIS using SVCs (Switched Virtual Circuits). To establish an SVC, the PowerCell software uses Q.2931 signalling, as specified in the ATM Forum's UNI (User-Network Interface) 3.0 Specification.

The PowerCell software does not support PVCs (Permanent Virtual Circuits).

After the PowerCell software establishes an SVC, the software encapsulates IP packets using IEEE 802.2 LLC/SNAP encapsulation, and segments the packets into ATM cells using AAL5 (ATM Adaptation Layer 5).

The default MTU (Maximum Transmission Unit) is 9,180 bytes. (When you add the SNAP header, the size becomes 9,188 bytes.). The maximum packet size is 9180.

5.1.2 ATM ARP Support

CLIP uses ATM ARP (ATM Address Resolution Protocol) and Inverse ATM ARP for address resolution within an LIS. ATM ARP is based on RFC 826 and Inverse ATM ARP is based on RFC 1293.

To configure a PowerCell segment to use an ATM ARP server in an LIS, you specify the ATM Address of the ATM ARP server when you configure the PowerCell segment for CLIP. (You perform this task and other tasks using the **`clip-set`** command. See Section 5.2.2 on page 103.)

Each LIS must have one ATM ARP server. The same ATM ARP server can be shared across multiple LISs, but an LIS cannot contain two operational ARP servers. The ATM ARP server must have authoritative responsibility for resolving ATM ARP Requests from all IP nodes within the LIS.

When you configure the ATM ARP server, you must configure an IP address for each LIS the server supports.

When you configure an IP node for CLIP, you specify the ATM address of the ATM ARP server in the LIS to which the node belongs. For example, when you configure a PowerCell segment for CLIP, one of the configuration tasks you must perform is specifying the ATM address of the ATM ARP server.

5.1.2.1 ATM ARP Table Aging

ATM ARP entries in the ATM ARP table on the ATM ARP server are valid for a minimum of 20 minutes. You configure the aging interval for the ATM ARP entries on the ATM ARP server itself. See the documentation for your ATM ARP server for information.

After the aging interval on the server expires, the server generates an Inverse ARP Requests on all open VCs (if there are any) associated with the ARP entry.

- If the server receives an Inverse ARP Reply on a VC, the entry is updated and the aging timer starts over for the entry.
- If the server does not receive at least one Inverse ARP Reply, the server removes the entry from its ATM ARP table.

5.1.3 MTU Size

The default MTU size for IP members operating over the ATM network is 9180 octets. The LLC/SNAP header is 8 octets, therefore the default ATM AAL5 protocol data unit size is 9188 octets. In Classical IP subnets, values other than the default can be used if and only if all members in the LIS have been configured to use the non-default value.

If a Classical IP packet is locally forwarded by the PowerCell module from one LIS to another LIS attached to the module, the packet is forwarded without being fragmented. However, if the PowerCell module sends the packet to the Packet Engine for processing (for example, if the packet is destined for a segment on another module in the PowerHub chassis), the module fragments the packet before sending it to the Packet Engine. The fragments can be a maximum of 4060 bytes long. The fragment sizes depend upon the destination medium (ATM, FDDI, or Ethernet).

5.2 CONFIGURING A POWERCELL SEGMENT FOR CLASSICAL IP

To use a PowerCell segment for Classical IP routing in an ATM network, you must perform the following configuration tasks for each segment:

- Configure an IP interface on the segment (if you have not already done so). (Use the **`ip add-interface`** command. See Section 2.13 on page 50.)
- Set the ATM protocol type to CLIP. (Use the **`segment-set`** command. See Section 2.10.1 on page 44.)
- Specify the ATM address of the ATM ARP server attached to the segment and enable Classical IP on the segment. (Use the **`clip-set`** command. See Section 5.2.2.)

The following sections describe how to perform these tasks.

5.2.1 Configuration Considerations

Before you begin configuring the PowerCell module for CLIP, make sure your configuration plans are not affected by the following considerations:

- You can configure only one IP interface on a PowerCell segment enabled for Classical IP.
- Broadcast traffic is not supported, as there is no mechanism in place to distribute broadcast packets. If the segments you want to configure will require the ability to send and receive broadcast traffic, you should use LANE 1.0 on the segments. (See Chapter 3.)
- PVCs (Permanent Virtual Circuits) are not supported. Connections to LIS hosts are established using SVCs (Switched Virtual Circuits.)
- You can configure one IP interface on a PowerCell segment, for a maximum of 32 IP interfaces on a PowerCell module.
- Layer-3 VLANs (Virtual LANs) are not supported on PowerCell segments configured for CLIP. To configure a Layer-3 VLAN on multiple PowerCell segments, you must use LANE 1.0 on the segments. (See Chapter 3.)
- Do not include the segments that you configure for CLIP in PowerHub bridge (network) groups.

5.2.2 Configuring a Segment for Classical IP on ATM

Before enabling CLIP on a segment, you must first configure the PowerCell segment to use PVC Bridging using the **`atm segment-set`** command. (See Section 2.10.1 on page 44 for more information on the **`atm segment-set`** command.) To configure the PowerCell segment to use CLIP, telnet into the PowerHub or connect to the PowerHub through the TTY interface, change to the **atm** subsystem, and configure the desired segment.

After you configure a PowerCell segment to use CLIP:

- Specify the ATM address of the ATM ARP server. (You must do this before you enable Classical IP on the segment.)
- Enable Classical IP on the segment.

To perform these tasks, use the **`clip-set`** command. Here is the syntax for this command:

`clip-set|clse` *<segment> <param> <value>*
[*<param> <value>...* **]]**

where:

<segment>	Specifies the PowerCell segment you are configuring for Classical IP.
<param> <value>	Specifies the Classical IP parameter and the value you are assigning to the parameter. You can specify the following parameters and values:

atmarp-svr|as *<arpsvr-atm-address>*

Specifies the ATM address of the ATM ARP server. Specify the address in NSAP (Network Service Access Point) format.

state|s enl|dis

Enables or disables the segment for Classical IP routing.

The default is **dis** (disabled).

Here are some examples of the **clip-set** command. The first command in this example specifies the ATM address of the ARP server on the LIS. The second command enables Classical IP on segment 22. In both cases, the terse form of the **clip-set** command is used.

```
10:PowerHub:atm#clse 22 as 45.0005.80.ffe100.0000.f215.1490.00-00-ef-01-ab-cd.04
Okay

11:PowerHub:atm#clse 22 s enl
Enable CLIP segment
```

5.2.3 Removing a Classical IP Segment

To remove CLIP from a segment, you disable the segment using the **clip-set** command and then remove the protocol form the segment using the **atm segment-set** command. The **clip-set** command is described in Section 5.2.2. The **atm segment-set** command is described in Section 2.10.1 on page 44.

Here are some examples of the commands used to disable a CLIP segment. The first command disables the segment and removes it from use, and the second command removes the CLIP protocol from the segment. In this example, the terse form of the **clip-set** and **atm segment-set** commands are used. Note that when you disable a segment, it is not necessary to specify the ARP server on the LIS.

```
12:PowerHub:atm#clse 22 s dis

13:PowerHub:atm#sse 22 s n
```

5.2.4 ATM Hardware Requirements for CLIP

The following sections describe requirements that must be met in the other ATM hardware in order for the hardware to be used with the PowerCell module for CLIP.

5.2.4.1 For Members of an LIS

The requirements for IP members (hosts, routers) operating in an ATM LIS (Logical IP Subnet) configuration are as follows:

- All members have the same IP network number, subnet number, and subnet mask.

- All members within the LIS must be directly connected to the ATM network. Members outside of the LIS can be accessed only by a router (such as the PowerHub system).
- All members of the LIS must have a mechanism for resolving IP addresses into ATM addresses using ATM ARP. Members attached by SVCs must be able to resolve IP addresses into ATM addresses using Inverse ATM ARP.
- All members within the LIS must be able to communicate through ATM with all other members of the same LIS. That is, the VC topology underlying the intercommunication among the members must have the ability to be fully meshed.

5.2.4.2 ATM Parameters for Classical IP

The following list identifies a set of ATM specific parameters that must be implemented on each IP node connected to the ATM network:

- The ATM address of the node. The address is resolved automatically by ILMI (Interim Link Management Interface).
- The ATM address of the ATM ARP server in the LIS to which the node belongs. In an SVC environment (such as the one including the PowerCell module), ATM ARP requests are sent to this address for the resolution of target protocol addresses to target ATM addresses. The ATM ARP server must have authoritative responsibility for resolving the ATM ARP requests of all the IP nodes in the LIS.

6 FORE IP

This chapter describes the PowerHub support for the FORE IP ATM protocol. FORE IP is a FORE Systems ATM protocol that emulates basic characteristics of an IP network.

> **NOTES**: If you are setting up a new ATM network, FORE Systems recommends that you use LANE 1.0 to bridge and route between ATM and Ethernet (and FDDI). Configure FORE IP on the PowerCell module only if your ATM network already uses FORE IP.
>
> The PowerHub 7000 cannot form FORE IP connections to FORE Systems model ASX-100 or ASX-200 ATM switches. The ASX-100 and ASX-200 support only AAL3/4, whereas FORE IP requires AAL 5. Connections can be formed ***through*** the switch, but not ***to*** the switch. FORE Systems model ASX-200BX and ASX-1000 do support AAL 5; therefore FORE IP connections can be made to these switches.
>
> FORE IP is not supported on the PowerCell 600.

6.1 IP CHARACTERISTICS EMULATED BY FORE IP

FORE IP emulates the following characteristics of the IP protocol:

- Address resolution using ARP (Address Resolution Protocol).
- Dynamic connection establishment and teardown.
- Broadcast and multicast capability.

The FORE-IP implementation incorporates these services in software, using FORE System's SPANS (Simple Protocol for ATM Network Signalling) and a CLS (Connectionless Service). SPANS and CLS are described in Section 6.2 on page 108.

> **NOTE**: The virtual interfaces that are created in FORE IP are based on IP and ATM addresses. The interfaces do not use MAC addresses to resolve destinations or routes. Because of this, all packets must be routed, not bridged, when destined for any other interfaces on the PowerHub switch.
> or
> The FORE IP implementation works on the Network layer of the OSI model, and resolves IP addresses to ATM address. It does not use MAC addresses so there are none to use to Bridge. Because of this, all traffic destined for other interfaces on the PowerHub switch must be routed.

6.2 THE POWERCELL MODULE AND FORE IP

FORE IP networks contain the following components:

SPANS (Simple Protocol for ATM Network Signalling)
: FORE System's proprietary signaling protocol for use in ATM local-area networks.

CLS (Connectionless Service)
: A service that provides transport of connectionless traffic (IP broadcasts, ARP requests and ARP responses) through the ATM network. An ATM network contains only one CLS. Connectionless traffic, including FORE IP traffic, is forwarded to and from the CLS using the well-known VPI/VCI pair 0,14.

6.2.1 ARP Requests and Responses

ARP requests and responses are sent over the connectionless service, in conformance with RFC 826. The HARDWARE Type value in the ARP packet is set to 4040 (hex). The protocol type is set to 0800 (the Ethernet Type for IP packets). The hardware addresses for FORE in the ARP packets are the 8-byte SPANS ATM addresses.

6.2.2 IP Broadcasts

IP broadcast packets are dealt with in the same manner as ARP packets are—over the predefined VPI/VCI pair of 0,14. 0,14 is the VPI/VCI pair used for the CLS (Connectionless Service).

6.2.3 Point-to-Point IP Packets

Point-to-point IP packets are connection-oriented in nature, therefore virtual circuits between IP hosts or ATM switches must be established. FORE-IP provides dynamic connection establishment using SPANS. For an existing connection between two IP hosts, IP packets are forwarded out the appropriate virtual circuit using the correct AAL type. If a connection does not exist, SPANS establishes a new connection.

6.2.4 IP Multicast

Point-to-multipoint connections are used for supporting IP multicast traffic over an ATM network, such that IP multicast packets can be transmitted from one source to multiple destinations. These point-to-multipoint connections are created using SPANS group addresses. An end station must first be added to the point-to-multipoint connection for the particular IP multicast group before the end station can receive IP multicast packets. The end station joins the multicast group by opening a point-to-multipoint connection to the group. IP Multicasting is supported by hardware point-to-multipoint connections on FORE Systems products, therefore no special multicast processing is needed to service such multicast packets.

> **NOTE**: Software version 7-2.6.4.0 does not contain multicast support.

6.3 CONFIGURING FOR FORE IP

To use the PowerCell module for routing in a FORE IP network, you must perform the following configuration tasks:

6.3.1 Configuring FORE IP on a PowerCell Segment

- Configure an IP interface on the segment (if you have not already done so). (Use the **`ip add-interface`** command. See Section 2.13 on page 50 and Chapter 5 in the *PowerHub Software Manual*.)
- Set the ATM protocol type to FORE IP. (Use the **`segment-set`** command. See Section 2.10.1 on page 44.)
- Enable FORE IP on the PowerCell segments you configured for FORE IP. (Use the **`foreip-set`** command. See Section 6.3.1.1.)

6.3.1.1 Enabling FORE IP on a PowerCell Segment

To enable FORE IP on a PowerCell segment, issue the following command:

`foreip-set|fse` *`<segment> <param> <value>`*

where:

`<segment>`	Specifies the PowerCell segment on which you are enabling FORE IP.
`<param> <value>`	Specifies the FORE IP parameter and the value you are assigning to the parameter. You can specify the following parameter:

`state|s enl|dis`

The state parameter enables or disables FORE IP on the segment you specified. The default is **`dis`** (disabled).

Here are some examples of this command. In the following example, FORE IP is enabled on segment 17.

```
1:PowerHub:atm# fore-ip set 17 state enl
```

6.3.1.2 Disabling FORE IP on a PowerCell Segment

To disable FORE IP on a PowerCell segment, you use the same command as you do to enable FORE IP, but with the **`state dis`** parameter and value. Here is an example of the command:

```
5:PowerHub:atm# fore-ip set 17 state dis
```

When FORE IP is disabled on the segment, the segment will display as disabled when you verify the PowerCell configuration using the **`atm segment-showcfg`** command. After you disable FORE IP, you can re-enable it, or assign another protocol to the segment using the **`atm segment-set`** command and configure the segment to use another protocol.

6.3.1.3 Verifying the FORE IP Configuration of a PowerCell Segment

The following example shows how to display the state of FORE IP on a PowerCell segment.

```
2:PowerHub:atm# segment-showcfg 17
```

6.3.2 Configuring the ATM Switch for FORE IP

The PowerCell module supports FORE IP, the FORE Systems proprietary protocol that emulates IP on the ATM network. FORE IP uses SPANS (Simple Protocol for ATM Network Signalling) 1.0, the FORE Systems proprietary signalling protocol, to dynamically establish and teardown VCs (Virtual Circuits).

> **NOTE**: You can disregard the procedures in this section if:
>
> - SPANS 1.0 on the ATM switch ports has already been configured for AAL5.
> - You do not plan to use the FORE IP protocol.
>
>   (You can reserve segments for FORE IP without actually enabling the protocol. If you have reserved FORE IP segments in this way, you must perform the configuration steps in Section 6.3.2.1. If you do not perform these steps, FORE IP will not operate when you enable the protocol on the reserved segments.)

In order for the ATM switch and the PowerHub system to communicate using FORE IP, both devices must be using the same AAL (ATM Adaptation Layer). For SPANS, the PowerCell module uses AAL5. However, by default, FORE Systems ATM switches support AAL3/4.

For the PowerCell module to communicate with FORE Systems ATM switches using FORE IP, you must change the SPANS AAL configuration on the port that directly connects the PowerCell module and the ATM switch to AAL5. The following section details how to change the SPANS AAL configuration on the ATM switch to AAL5.

6.3.2.1 Changing the SPANS AAL Configuration on the ATM Switch

To change the SPANS AAL configuration to AAL5, issue the following commands from the AMI (ATM Management Interface) on the FORE Systems ATM switch.

> **NOTE**: You can disregard the procedures in this section if the ports on your ATM switch have already been configured for AAL5.

(1) Delete the current SPANS configuration from the ATM port by issuing the following command:

`configuration spans delete` *`<port> <vpi>`*

where:

`<port>`	Specifies the port number on the FORE Systems ATM switch. You can specify only one port at a time.
`<vpi>`	Specifies the VPI (Virtual Path Identifier) configured on the ATM port. For information about viewing your VPI number, consult the documentation that accompanied your FORE Systems ATM switch.

(2) Add the new SPANS configuration, including the new AAL type, to the ATM port by issuing the following command:

`configuration spans new` *`<port> <vpi>`* **`-aal 5`**

where:

`<port>`	Specifies the port number on the ATM switch. You can only specify one port at a time.
`<vpi>`	Specifies the VPI (Virtual Path Identifier) configured on the ATM port.
`-aal 5`	Specifies that the port will use AAL5.

> **NOTE**: It is not necessary to disable the `asx0` interface before deleting the SPANS configuration for the ATM port. However, the `asx0` interface must be enabled on the ATM port in order to run the FORE IP protocol. You enable the `asxo` interface by issuing the following command:
>
> **`configuration ip admin asx0 up`**
>
> For more information on the **`configuration ip admin`** command, see the *ForeRunner ATM Switch Configuration Manual.*

6.3.3 Configuring Your FORE IP Network for Failover

You can configure your FORE IP network so that network connections are sustained if a failure occurs in one of the links between the PowerCell modules and ATM switches. To configure for failover, you need at least two PowerCell systems containing PowerCell modules and at least two ATM switches.

Figure 6–1 shows an example of a FORE IP failover configuration.

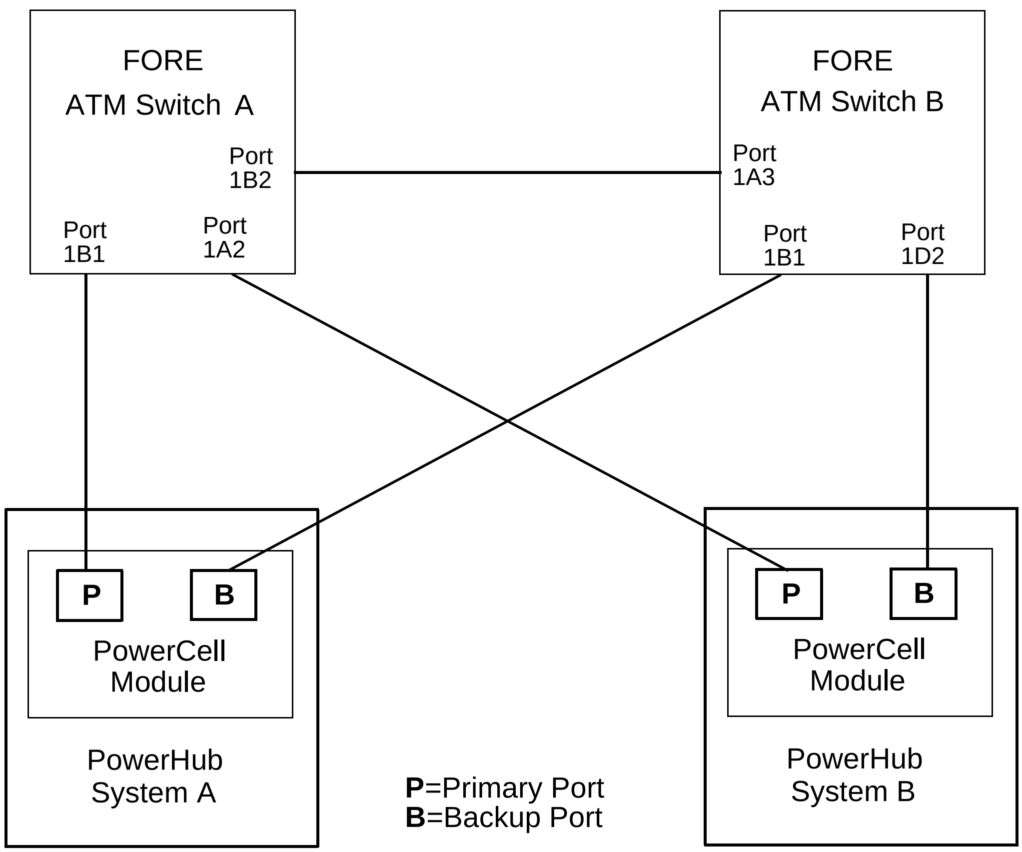


FIGURE 6–1 Failover configuration for FORE IP.

To set up the configuration shown in Figure 6–1:

(1) Connect the PowerHub modules to the ATM switches as shown in Figure 6–1.

(2) If you have not already done so, configure the FORE IP ports on the ATM switches to use interface `asx0`. See Section 6.3.2 on page 110 for instructions.

(3) If you have not already done so, enable FORE IP on the PowerCell segments you are using for the FORE IP connections with the ASX switches. See Section 6.3.1 on page 109 for instructions.

> **NOTE**: It is not important which ports on the ATM switches the Fiber or UTP cables are plugged into, as long as the primary and backup ports on the PowerCell are connected to the correct switches as shown in Figure 6–1.

Appendix A: The ATM Commands

This appendix describes the commands in the **atm** subsystem. These commands let you configure and manage the PowerHub system as an edge device between Ethernet, Fast Ethernet (and FDDI), and ATM.

The information in this appendix is for reference. If you need instructions for configuring a PowerCell segment to use a specific ATM protocol, see the appropriate chapter in this addendum:

- To configure LANE 1.0 parameters, see Section 3.5 on page 63.
- To configure parameters for RFC-1483 Encapsulation over PVC, see Section 4.2 on page 88.
- To configure FORE IP parameters, see Section 5.2 on page 102.
- To configure FORE IP parameters, see Section 6.3 on page 109.

NOTE: FORE IP is not supported on the PowerCell 600.

A.1 ACCESSING THE ATM SUBSYSTEM

To access the **atm** subsystem, issue the following command at the runtime prompt:

```
atm
```

A.2 ATM SUBSYSTEM COMMANDS

Table 1–1 lists and describes the **atm** subsystem commands. For each command, the management capability is listed, as well as the section that contains additional information about the command. (The management capability is explained in the "Getting Started with the User Interface" chapter in the *Installation and Configuration Manual* for your PowerHub system.)

TABLE 1–1 ATM subsystem commands.

Command and Description	Capability*	See…
ama-set|ase *<slot> <param> <value>* Selects the AMA (PHY) to be used for ATM traffic. (PowerCell 700 only.)	R	A.4.1
ama-showcfg|ascf *<slot>***|all** Displays the configurations of the primary and (if present) backup AMAs (PHYs).	R	A.4.1.2
atm-vc-show|avc <segment>|all Displays all VCs which are active on specified ATM segment(s).	R	
br-encap-set|bse *<segment>* **[***<param> <value>* **[***<param> <value>...***] state|s enl|dis** Enables or disables RFC-1483 Encapsulation on the specified segment.	R	A.4.4.1
br-encap-showcfg|bscf *<segment>***|all** Displays the RFC-1483 Encapsulation configuration for the specified PowerCell segments(s).	R or M	A.4.4.2
bus-add|buadd *<elan-name> <slot> <bus-SELbyte>* Configures a LANE BUS on the PowerCell module in the specified slot (PowerCell 700 only).	R	A.4.3.8
bus-del|budel *<elan-name> <slot>* Deletes a BUS from the PowerCell module in the specified slot (PowerCell 700 only).	R	A.4.3.10
bus-stats|bust *<elan-name> <slot>***|all** Displays statistics for a BUS on the PowerCell module in the specified slot (PowerCell 700 only).	R	A.4.3.9
clip-arptable-clear|clac Clears the Classical IP ATM ARP table.	R	A.4.5.4
clip-set|clse *<segment> <param> <value>* **[***<param> <value>***]** Configures a PowerCell segment for Classical IP over ATM.	R	A.4.5.1
clip-arp-table|clat *<segment>***|all** Displays a table listing the active VCs and the ATM ARP addresses for the LIS (logical IP subnet).	R or M	A.4.5.3

TABLE 1–1 (Continued) ATM subsystem commands.

Command and Description	Capability*	See…
clip-showcfg|clsh *<segment>***|all** Displays the Classical IP configuration for the specified PowerCell segments(s).	R or M	A.4.5.2
clip-stats|clst *<segment>***|all** Displays clip statistics for the specified PowerCell segments(s).	R or M	A.4.5.5
clip-stats-clear|clsc *<segment>***|all** Clears the clip statistics accumulated for the specified PowerCell segments(s).	R	A.4.5.6
elan-add|eadd *<elan-name> <segment>* **[***<les-atm-address>***]** Associates an ELAN with a segment.	R	A.4.3.2
elan-arptable|eat *<elan-name>***|***<MAC-address>***|all** Displays the LE_ARP table for an ELAN.	R or M	A.4.3.14
elan-arptableclear|eatc *<elan-name>***|all** Clears LE_ARP table entries for an ELAN.	R	A.4.3.15
elan-configure|elco *<elan-name> <segment> <param> <value> [<param><value>..[<param><value>]]* Enables/disables LE Client on specified ELAN and segment.	R	A.4.3.1
elan-del|edel *<elan-name>* Deletes an ELAN from the PowerCell segment.	R	A.4.3.3
elan-set|ese *<elan-name>***|all** *<param> <value>* **[***<param> <value>***...[***<param> <value>***]]** Sets ATM configuration parameters for an ELAN.	R	A.4.3.20
elan-showcfg|escf *<elan-name>***|all** Shows configuration information for an ELAN.	R or M	A.4.3.19
elan-stats|est *<elan-name>***|all elan|if|all** Shows ELAN-specific (**elan**) or interface-specific (**if**) statistics for an ELAN.	R or M	A.4.3.17
elan-statsclear|estc *<elan-name>***|all** Clears statistics for an ELAN.	R	A.4.3.18
elan-vctable|evt *<elan-name>***|all** Lists the VCs (Virtual Circuits) that are in use by an ELAN.	R or M	A.4.3.16
foreip-set|fse *<segment> <param> <value>* Enables or disables FORE IP on the specified segment (PowerCell 700 only).	R	A.4.6.1

TABLE 1–1 (Continued) ATM subsystem commands.

Command and Description	Capability*	See…
foreip-show-cache|fsoc *<segment>* Displays the FORE-IP cache for the specified segment (PowerCell 700 only).	R or M	A.4.6.2
foreip-statistics|fst *<segment>* Displays FORE-IP statistics for the specified segment (PowerCell 700 only).	R or M	A.4.6.3
foreip-stats-clear|fstc *<segment>* Clears FORE-IP statistics for the specified segment (PowerCell 700 only).	R or M	A.4.6.4
lec-set|lse *<slot>*|**all** *<param> <value>* **[***<param> <value>***]** Configures the specified PowerCell module as a LEC (LAN Emulation Client).	R	A.4.3.12
lec-showcfg|lscf *<slot>*|**all** Displays LANE 1.0 configuration information for the specified PowerCell module.	R or M	A.4.3.13
les-add|leadd *<elan-name> <slot> <les-SELbyte> <bus-SELbyte>* **[rate-group]|***<bus-atm-address>* Configures a LES or colocated LES/BUS on the PowerCell module in the specified slot (PowerCell 700 only).	R	A.4.3.4
les-del|ledel *<elan-name> <slot>* Deletes a LES from the PowerCell module in the specified slot (PowerCell 700 only).	R	A.4.3.7
les-showmember|lesm *<elan-name> <slot>*|**all** Displays membership information for the LES on the PowerCell module in the specified slot (PowerCell 700 only).	R	A.4.3.6
les-stats|lest *<elan-name> <slot>*|**all** Displays statistics for the LES on the PowerCell module in the specified slot (PowerCell 700 only).	R	A.4.3.5
rate-set|rse *<slot> <rate-group> <rate>* Configures a rate group for the specified NIM slot (PowerCell 700 only).	R	A.4.2.1
rate-showcfg|rscf *<slot>*|**all** Shows rate group information for the PowerCell module in the specified slot (PowerCell 700 only).	R or M	A.4.2.2
segment-set|sse *<segment-list>*|**all** *<param> <value>* **[***<param> <value>***]** Specifies the protocol to be used on a segment and associates the segment with a rate group.	R	A.4.2.3

TABLE 1–1 (Continued) ATM subsystem commands.

Command and Description	Capability*	See…
segment-showcfg|sscf *<segment>***|all** Shows configuration information for the specified PowerCell segment.	R or M	A.4.2.4
service-show|sescf *<elan-name>***|all** *<slot>***|all [les|bus]** Shows the service (LES and BUS) configuration for the PowerCell module in the specified slot (PowerCell 700 only).	R or M	A.4.3.11
***R= Root; M=Monitor		

A.3 GETTING ON-LINE HELP

All PowerHub models have on-line help to help you navigate through the user interface. You can get the following types of on-line help:

- General help.
- Subsystem help.
- Command-specific help.

To access general help, issue the following command:

findcmd|fcmd

This command lists all the commands in all the subsystems.

To display a list of commands within a subsystem, issue the following command:

help|h

This command displays information for only the subsystem which you are currently using.

To use command-specific help, issue the following command:

help|h *<command-name>*

Command-specific help provides information for the command you specify. Separate “**help**” from the command name by using a space.

A.4 ATM COMMANDS

The following sections describe the ATM commands:

- PHY (AMA) selection commands let you select a PHY and display information about the PHYs. (See Section A.4.1.)
- Segment configuration commands let you define rate groups, and assign rate groups and ATM protocols to PowerCell segments. (See Section A.4.2 on page 123.)
- LANE 1.0 commands let you configure the PowerCell module for LANE 1.0 and display LANE 1.0 tables, parameters, and statistics. (See Section A.4.3 on page 129.)
- RFC-1483 Encapsulation over PVC commands let you configure PVCs between the PowerHub 7000 and an ATM switch. (See Section A.4.4 on page 151.)
- CLIP commands let you enable CLIP (Classical IP over ATM) routing on a PowerCell 700 segment, and display or clear the CLIP cache and CLIP statistics for a PowerCell 700 segment. (See Section A.4.5 on page 153.)
- FORE IP commands let you enable FORE IP routing on a PowerCell 700 segment, and display the FORE IP cache and FORE IP statistics for a PowerCell 700 segment. (See Section A.4.6 on page 158.)

Some of these commands are mentioned in the configuration procedures in Section 2.14 on page 51.

A.4.1 ATM Port (PHY) Selection Commands

The commands in this section enable you to select and display information about the primary and backup port (PHY) on the PowerCell 700 and PowerCell 600. (See Section A.4.1.)

A.4.1.1 Selecting a Port

The PowerCell software uses the primary port by default. If the link to the primary port fails, the backup port automatically takes over, provided you have established a redundant link to the port switch by connecting the backup port to the switch. Also, if you are using the backup port and it fails, the software switches back to the primary port (provided the primary port is good).

After you correct the problem that led to the link failure on the primary port, you must manually change to the primary port if you want to use it again. You can manually switch between the backup port and the primary port using the **`ama-set`** command.[1]

> **NOTE**: When you change from one port to the other, your connection to the ATM switch (and therefore the ATM network) is temporarily lost while the software switches the connections to the new port.

Here is the syntax for the **ama-set** command:

ama-set|ase *<slot> <param> <value>*

where:

<slot> Specifies the slot that contains the PowerCell module.

- On the PowerHub 7000, the slots are labeled on the PowerHub chassis.
- On the PowerHub 6000, the PowerCell 600 is always in slot 2.

On both PowerHub models, you also can determine the slot number using the **mgmt showcfg** command.

<param> <value> Specifies the port parameter.

select-card|sc primary|p | backup|b

Selects the port you want to use. If you specify **primary**, the port labeled PRIMARY is used. If you specify **backup**, the port labeled BACKUP is used. The default is **primary**.

> **NOTE**: If the PowerCell module contains a backup port but the backup port is bad, the software attempts to switch to the backup port, recognizes the port is not available, then immediately switches back to the primary port. Connection to the ATM switch is temporarily lost, then quickly re-established.

Here is an example of this command:

```
1:PowerHub:atm# ama-set 4 select-card primary
```

This command selects the primary port. To save the port selection, save the PowerHub configuration using the **mgmt svcfg** command or the **tftp svcfg** command. (See Section 2.15 on page 53.)

A.4.1.2 Verifying the ATM Port Selection

Use the **ama-showcfg** command to indicate the port that has been selected for use and the port that actually is in use. Here is the syntax for this command:

ama-showcfg|ascf *<slot>***|all**

where:

*<slot>***|all** Specifies the slot that contains the PowerCell module.

- On the PowerHub 7000, the slots are labeled on the PowerHub chassis.
- On the PowerHub 6000, the PowerCell 600 is always in slot 2.

1. The port-selection commands contain the word “ama” in reference to the AMA (ATM Media Adapter) on the PowerCell 700. Each ATM port on the PowerCell 700 is provided by an AMA. The PowerCell 600 does not contain AMAs, but the commands described in this section provide the same function for the PowerCell 600 as they do for the PowerCell 700.

On both PowerHub models, you also can determine the slot number using the **mgmt showcfg** command. If you specify **all**, the AMA information is shown for all the PowerCell modules in the chassis.

Here is an example of the display produced by this command. In this example, the primary port is both selected and in use.

```
1:PowerHub:atm# ama-showcfg 4
AMA Configurations for Slot 4:

                    Primary AMA          Backup AMA
------------------------------------------------------------------------
User Selected AMA : PRIMARY
Actual In Use AMA : PRIMARY
PHY UTOPIA Level  : 1                    1
PHY UTOPIA Version: 2                    2
PHY Protocol Type : 155M OC3             155M OC3
PHY Media Type    : Multimode Fiber      Multimode Fiber
```

The fields in this display show the following information:

`User Selected AMA` — The port you specified for normal operation. Unless you explicitly change the port assignments, the software uses the primary port by default and the backup port only if the link to the primary port fails.

`Actual In Use AMA` — The port that is actually being used. If the link to the primary port fails, this field shows that the backup port is in use, even though the primary port was selected for use.

`PHY UTOPIA Level` — The PHY UTOPIA level in use by the PowerCell module and port. UTOPIA is an ATM standard for the communication between the PowerCell module and the PHY (port).

`PHY UTOPIA Version` — The version of the PHY UTOPIA in use by the PowerCell module and the port.

`PHY Protocol Type` — The PHY-layer protocol in use on the port. The protocol must be the following:

- `155M OC3` — 155 Mb/s using an OC-3 connector.

`PHY Media Type` — The type of cable connecting the port to the ATM switch. The cable type can be one of the following:

- `CAT5 UTP`
- `Coaxial Cable`
- `Multimode Fiber`
- `Single Mode Fiber`

Normally, the primary port is selected by the software and used for ATM traffic between the PowerCell module and the ATM switch. However, if the primary link fails or you explicitly select the backup port, the PowerCell uses the backup port. The **ama-showccfg** command shows that the backup port is in use as follows:

```
2:PowerHub:atm# ama-showcfg 4
AMA Configurations for Slot 4:

                    Primary AMA          Backup AMA
------------------------------------------------------------------------
User Selected AMA : PRIMARY
Actual In Use AMA :                      BACKUP
PHY UTOPIA Level  : 1                    1
PHY UTOPIA Version: 2                    2
PHY Protocol Type : 155M OC3             155M OC3
PHY Media Type    : Multimode Fiber      Multimode Fiber
```

Notice that the `Actual In Use AMA` field (shown in bold type in this example) lists the backup port in use, even though the primary port is selected. To use the primary port again, you must correct the problem that caused the primary link to fail, then use the **ama-set** command to select the primary port. (See Section A.4.1 on page 120.)

A.4.2 Segment Configuration Commands

The commands in this section let you configure rate groups and assign an ATM protocol and rate group to each ATM segment.

NOTE: Rate groups are supported on the PowerCell 700 only.

A.4.2.1 Configuring a Rate Group

To configure a rate group for the PowerCell module, issue the following command.

rate-set|rse *<slot> <rate-group> <rate>*

where:

<slot> Specifies the slot that contains the PowerCell module. The slots are labeled on the PowerHub 700 chassis. You also can determine the slot number using the **mgmt showcfg** command.

<rate-group> Specifies the rate group. Specify a number from **1** through **16**. The default rate group for all segments is **1**.

<rate> Specifies the rate. You can specify the rate in Mb/s or Kb/s.

- To specify the rate in Kb/s, enter "**k**" or "**K**" after the number. For example, to specify 45000 Kb/s, enter the number as **45000k** or **45000K**.
- To specify the rate in Mb/s, enter "**m**" or "**M**" after the number. For example, to specify 45 Mb/s, enter the number as **45m** or **45M**.

If you do not indicate whether the rate is in Kb/s or Mb/s, the software assumes Kb/s.

> **NOTE**: If you have rate groups that you configured in a software version earlier than 7-2.6.4.0, the PowerHub software converts the rates to Kb/s when you save the configuration file. Therefore the rates are not changed, but their representation is changed.

You can specify a rate from 1 to 155000 Kb/s for group 1 or a rate from 0 through 155000 Kb/s for groups 2 through 16. The default for rate group 1 is 155000 Kb/s. The default for rate groups 2 through 16 is 0 Kb/s.

When you configure the rate group, specify a bit rate that is equal to or lower than the maximum bit rate supported by the physical interface type of the ATM port. For example, if the ATM port is an OC-3 port, the port can transmit at 155000 Kb/s or lower. If you apply a rate group with a higher bit rate to the port, the port still will transmit at 155000 Kb/s or less.

The PowerCell software uses rate group 1 for all ATM signalling and ILMI traffic. Therefore, do not configure rate group 1 for 0 Kb/s unless you want to eliminate ATM signalling and ILMI traffic on the PowerCell module.

Rate groups configured for 0 (zero) Kb/s or Mb/s have no bandwidth and therefore are not used.

> **NOTE**: The total for all the rate groups for the PowerCell module must be 155000 Kb/s or less.

Here is an example of the **`rate-set`** command. In this example, rate group 3 is configured to provide 450000kb/s.

```
3:PowerHub:atm# rate-set 4 3 45000K
```

A.4.2.2 Displaying Rate Groups

To display configuration information about the rate groups configured for the PowerCell module, issue the following command:

`rate-showcfg|rscf` *`<slot>`***`|all`**

where:

*`<slot>`***`|all`** Specifies the chassis slot that contains the PowerCell 700. The slots are labeled on the PowerHub 7000 chassis. You also can determine the slot number using the **`mgmt showcfg`** command. If you specify **`all`**, the rate groups are displayed for all the PowerCell modules in the chassis.

Here is an example of the information displayed by this command. In this example, the rate group configuration for the PowerCell module in slot 4 is displayed.

```
3:PowerHub:atm# rate-showcfg 4

Rate Group Settings For Slot: 4

---------------------------------------------------------------------------
Group  1:  100000 Kbps
Group  2:    6000 Kbps
Group  3:    3000 Kbps
Group  4:    4000 Kbps
Group  5:       0 Kbps
Group  6:       0 Kbps
Group  7:       0 Kbps
Group  8:       0 Kbps
Group  9:       0 Kbps
Group 10:       0 Kbps
Group 11:       0 Kbps
Group 12:       0 Kbps
Group 13:    5000 Kbps
Group 14:    6000 Kbps
Group 15:    7000 Kbps
Group 16:    8000 Kbps

Total   :  139000 Kbps
Idle    :   16000 Kbps
```

As shown in this example, the Kb/s allocated to each of the 16 rate groups is listed. Following the listings for the individual rate groups, this display lists the total Kb/s allocated among all 16 rate groups and the amount of idle (unallocated) Kb/s, if any.

A.4.2.3 Configuring ATM Segments

You can configure up to 32 logical segments on the PowerCell 700 and up to 16 logical segments on the PowerCell 600. For each segment, you can specify the protocol and the rate group used by that segment. Each segment on the PowerCell module can be configured for only one protocol and one rate group.

> **NOTE**: The segments must already be allocated to the chassis slot that contains the PowerCell module. You allocate segments using the **nvram set slotsegs** command. (See Section 2.7 on page 36.)

To configure the protocol and rate group for a segment on the PowerCell module, issue the following command:

segment-set|sse *<segment-list>***|all** *<param> <value>*
[*<param> <value>***]**

where:

*<segment-list>***|all**

Specifies the PowerCell segment you are configuring. You can specify a single segment number, a comma-separated list of segments, or a hyphen-separated range of segments. If you specify

all, all the segments on all the PowerCell modules in the chassis are configured to use the ATM protocol and rate group you specify.

<param> <value> Specifies the ATM segment parameter and the value you are assigning to the parameter. You can specify one of the following parameters:

protocol|p *<value>*

Specifies the protocol to be used on a segment. You can specify one of the following for *<value>*:

fore-ip|fip	FORE IP.
lane|l	LANE (LAN Emulation) 1.0.
classical-ip|c	Classical IP over ATM (see RFC 1577).
bridge-encap|b	RFC-1483 Encapsulation over PVC.
None|n	Removes a disabled protocol from a segment.

The default is **lane**.

> **NOTE**: RFC-1483 Encapsulation, FORE IP, and CLIP are supported only on the PowerCell 700, and only in software version 7-2.6.4.0 and greater. They are not supported on the PowerCell 600.

rate-group|rg *<rate-group>*

Associates a segment with a rate group. You can specify a rate group number from **1** through **4**.

You define the rate groups using the **rate-set** command. (See Section A.4.2.1 on page 123.) The default rate group for all segments is **1**.

A.4.2.4 Displaying Configuration Information for ATM Segments

To display configuration information for segments on a PowerCell module, issue the **segment-showcfg** command. This command displays the protocol and rate group you configured on the segment using the **segment-set** command.
(See Section A.4.2.3 on page 125.)

segment-showcfg|sscf *<seg-list>***|all**

where:

*<seg-list>***|all** Specifies the segments. You can specify an individual segment number, a comma-separated list of segment numbers, or a hyphen-separated range of segment numbers. If you specify **all**, configuration information is displayed for all the segments on the PowerCell module.

Here is an example of the information displayed by this command. In this example, the ATM configuration for segment 19 is displayed.

```
4:PowerHub:atm# segment-showcfg 19

   Segment             Protocol      State Rate Group
---------- ------------------- ---------- ----------
        19                None   Disabled          1
```

The fields in this display show the following information:

`Segment` Lists the PowerHub segment number.

`Protocol` Lists the ATM protocol assigned to the segment. The protocol can be one of the following:

`fore-ip`	FORE IP.
`lane`	LANE (LAN Emulation) 1.0.
`classical-ip`	CLIP (Classical IP over ATM); see RFC 1577.
`RFC-1483`	RFC-1483 Encapsulation over PVC.

`State` Indicates the state of the ATM protocol. If the protocol is disabled, you can enable it using the appropriate command:

- To enable the FORE IP protocol, use the **`foreip-set`** command.
- To enable the LANE 1.0 protocol, use the **`lec-set`** command.
- To enable the CLIP protocol, use the **`clip-set`** command.
- To enable RFC-1483 Encapsulation, use the **`br-encap-set`** command.

`Rate-Group` Indicates the rate group assigned to the segment.

A.4.2.5 Displaying Virtual Circuits for Specified ATM Segments

To display the active VCs on specified segments, issue the **`atm-vc-show`** command. This command will display the number of VCs configured on the specified segments.

Here is the syntax for this command:

`atm-vc-show|avc` *<segment>***`|all`**

where:

*<segment>***`|all`** Specifies the segment number of the segment you which you want information. If you specify **`all`**, the information is listed for all active segments.

The following information is listed:

For each LANE-enabled segment:

LEC Configuration Direct PP SVC

LEC Control Direct PP SVCLEC Control Distribute PMP SVC

LEC Multicast Send PP SVC

LEC BUS Multicast Forward PMP SVC

LES Control Distribute PMP SVC, if LES is on ATM card.

All LES Control Direct PP SVCs, if LES is running on ATM card.

BUS Multicast Forward PMP SVC, if BUS is running on ATM card.

All LEC Data Direct PP SVCs

For FORE-IP-enabled segments:

All FOREIP Input and Output SVCs.

For each 1483-Bridge-Encapsulation-enabled segment:

Input and output 1483 PVCs.

For each CLIP-enabled segment:

SVC to CLIP ARP Server on same LIS.

All SVCs to remote CLIP clients on same LIS.

Here is an example of the information displayed by the **`atm-vc-show`** command. In this example, only segment 19 has active VCs and of the 32 segments on the PowerHub, only two are configured. Segment 14 has been configured for a protocol, but does not currently have any active VCs. The PVCs that are shown at the bottom of the display are for signalling purposes and should not be removed.

```
31:PowerHub:atm# avc all

Total Active VCs on Segment 14: 0


Total Active VCs on Segment 19: 2
 Inbound: 300
Outbound: 400

Active Signaling PVCs < 32 on ATM Slot 2:
 5 16
Total Active VCs on ATM Slot 2: 4
```

A.4.3 LANE 1.0 Commands

The commands in this section let you configure PowerCell segments for use with LANE 1.0.

A.4.3.1 Adding a PowerCell LEC to an ELAN using the `elan-configure` *command*

Use the **`elan-configure`** command to add or remove an ELAN on a PowerCell segment. This command simplifies the process of adding and deleting ELANs by replacing the **`elan-add, elan-del`**, and **`lec-set`** commands. Using the **`elan-configure`** command, LECS usage is set once and ELANs join the LECS on a per-segment basis. You do not need to reset LECS usage after adding a new ELAN.

When using the **`elan-configure`** command, the parameters and values applied when the first segment is configured are applied to the entire slot. To change the parameters for the slot, all the ELANs must first be disabled.

When you disable an ELAN using the **`elan-configure`** command, the ELAN is removed, and the LECS usage disabled for that segment.

Here is the syntax for the **`elan-configure`** command:

`elan-configure|elco` *<elan-name> <segment> <param> <value>*
[<param><value>...[<param><value>]]

where:

`<elan-name>` Specifies the name of the ELAN you wish to add or delete.

<segment> Specifies the segment number of the ELAN you wish to add or delete.

`<param> <value>` Specifies the configuration parameter and the value you are assigning to the parameter. You can specify one or more of the following parameters:

`state|s enl|dis`

Enables or disables the use of the LECS by the LE Client on the specified segment.

If the **`state`** parameter is used with the value **`enl`**, and you do not specify the LES address using the **`les-address`** or **`lecs-usage`** parameter, the well-known address is used.

If the **`dis`** value is used, the ELAN is removed from the segment.

The **`state`** parameter is necessary for the LE Client to join the network.

`les-address|la <les-atm-address>`

Specifies ELAN LES address. The **`les-address`** parameter is required when the LECS has not been configured or when the LECS usage is not set. The LE Client forms a connection directly to the specified LES instead of the LECS.

`lecs-usage|lu <lecs-atm-address>`

Specifies the LECS to be used by the LE Client. When the **`lecs-usage`** parameter is used, the well known address is not used, but an LECS is enabled using the address provided. This parameter is used when the LECS is not located at the well-known address, and the **les-address** parameter is not set.

> **NOTE**: The **lecs-usage** parameter that is used to configure the first segment is applied to the entire slot. If you wish to change the LECS usage for the slot, you must first disable all ELANs using the **elan-configure** command with the **state dis** parameter and value. Then the parameters set for the first ELAN that you re-configure will be applied to the entire slot.

A.4.3.2 Adding the PowerCell LEC to an ELAN using the `elan-add` *command*

An ELAN (Emulated LAN) lets you forward traffic between Ethernet and FDDI LANs and ATM LANE 1.0 LANs. After you configure the protocol and rate group for each segment on the PowerCell module, you can add an ELAN to each segment.

FORE Systems recommends that you use the **elan-configure** command to add ELANs to the PowerCell module. The **elan-configure** command eliminates the need to type two commands in order to create and enable an ELAN, and allows you to add an ELAN without having to disable and then re-enable the LEC on the slot.

> **NOTE**: If you use the **elan-configure** command to add ELANs, discontinue using the **elan-add**, **elan-del**, or **lec-set** command. Using the **lec-set** command may disable the ELANs configured with the **elan-configure** command and require you to delete and then re-add those ELANs.

You must add an ELAN (Emulated LAN) name to a segment before you can use that segment for ATM forwarding. If you already have one or more ELANs configured on the PowerCell module, you must disable the LEC on the PowerCell module by issuing the **lec-set** command. After you add the ELAN on the segment, you must re-enable the LEC using the **lec-set** command. See Section A.4.3.12 on page 139 for information on the **lec-set** command.

To add an ELAN name to an ATM segment, issue the following command:

elan-add|eadd *<elan-name> <segment>* **[***<les-atm-address>***]**

where:

<elan-name> Is a name from one to 32 characters in length. You can use alphabetic characters, numerals, and special characters in the name, but you cannot use blank spaces. ELAN names are case-sensitive.

<segment> Specifies the segment. Each ELAN name can be assigned to only one PowerCell segment within the same PowerHub system.

<les-atm-address>

Specifies the LES (LAN Emulation Server) address of the ELAN you are adding to this segment. If you do not specify the LES address, the PowerCell software will try to get the LES address from the LECS.

> **NOTE**: If you did not configure the LECS on your ATM switch or enable LECS usage on the PowerCell module, you must specify the LES address when you add the ELAN.

A.4.3.3 Deleting an ELAN Name from the PowerHub System

FORE Systems recommends that you use the **`elan-configure`** command to delete ELANs from the PowerCell module. The **`elan-configure`** command eliminates the need to type two commands in order to disable and delete an ELAN, and allows you to delete an ELAN without having to disable and then re-enable the LEC on the slot.

> **NOTE**: If you use the **`elan-configure`** command to add ELANs, do not use the **`elan-del`**, **`elan-add`**, or **`lec-set`** command. Using the **`lec-set`** command may disable the ELANs configured with the **`elan-configure`** command and require you to delete and then re-add those ELANs.

To delete an ELAN name from the PowerHub system, issue the following command:

`elan-del|edel` *`<elan-name>`*

where:

`<elan-name>`	Is the ELAN name.

A.4.3.4 Adding a LES or a Colocated LES/BUS on the PowerCell 700

To add a LES and BUS on the PowerCell 700, issue the following command:

les-add *<elan-name> <slot> <les-SELbyte>*
*<bus-SELbyte>***|***<bus-atm-address>*

where:

<elan-name> Is the ELAN that the LES, BUS, or LES/BUS pair you are creating will serve. You can specify an alphanumeric name from 1 to 32 characters in length.

<slot> Is the chassis slot that contains the PowerCell 700. The slots are labeled on the PowerHub 700 chassis. You also can determine the slot number using the **mgmt showcfg** command.

<les-SELbyte> Is the Selector byte of the LES. The Selector byte is the final two hexadecimal digits in an NSAP ATM address. You can specify the hexadecimal digits alone or use “0x” to flag them. In either case, the software assumes that the digits are hexadecimal.

*<bus-SELbyte>***|***<bus-atm-address>*

Is the Selector byte of the BUS or the full ATM address of the BUS.

- If you specify the selector byte only, the PowerCell software colocates the BUS with the LES. You can specify the Selector bytes’ hexadecimal digits alone or use “0x” to flag them. In either case, the software assumes that the digits are hexadecimal.
- If the BUS is on another device (not the PowerCell module), you must specify the full NSAP ATM address of the BUS.

Here are some examples of this command. In the following example, a colocated LES/BUS is added to the PowerCell 700 in slot 1. The LES/BUS will serve the ELAN named “engineering.” Notice that in this example, the Selector bytes are flagged using the “0x” flag. This flag is optional.

```
4:PowerHub:atm# les-add engineering 1 0x10 0x20
```

In the following example, a LES for an ELAN called “marketing” is added to the PowerCell 700 in slot 2. The Selector byte of the LES is 30 (hexadecimal). Because the BUS is on another device, the full ATM address of the BUS is specified. By specifying the ATM address of the BUS, you inform the LES of the location of the BUS in your ATM network.

```
4:PowerHub:atm# les-add marketing 2 0x30 47:0005:80ff:e100:0000:f21a:2c00:0000ef042990:20
```

A.4.3.5 Displaying LES Statistics

To display LES statistics for a LES configured on the PowerCell 700, issue the following command.

`les-stats|lest` *`<elan-name>`***`|all`** *`<slot>`***`|all`**

where:

*`<elan-name>`***`|all`**

Is the name of the ELAN the LES or colocated LES/BUS pair serves. If you specify **`all`**, statistics for all the LESs and colocated LES/BUSs on the PowerCell 700 in the specified slot are displayed.

*`<slot>`***`|all`** Is the chassis slot that contains the PowerCell 700. The slots are labeled on the PowerHub 700 chassis. You also can determine the slot number using the **`mgmt showcfg`** command. If you specify **`all`**, statistics for all the LESs and colocated LES/BUSs on all PowerCell 700 Modules in the PowerHub chassis are displayed.

> **NOTE**: This command displays information only for LESs configured on the PowerHub 7000. To display statistics for a LES configured on an ATM switch or ATM adapter card, use the appropriate commands on that switch or adapter card.

Here is an example of the information displayed by this command.

```
4:PowerHub:atm# les-stats engineering 1
LES Statistics for: elan1

---------------------------------------------------------------------------
Join Requests In        :          1
ARP Requests In         :          1
ARP Responses Out       :          1
ARP Requests Forwarded  :          0
Unknown Control In      :          0
```

The fields in this display show the following information:

`Join Requests In` Indicates how many join requests the LES has received.

`ARP Requests In` Indicates how many ARP requests the LES has received.

`ARP Responses Out` Indicates how many ARP responses have been sent by the LES for the ELAN.

`ARP Requests Forwarded` Indicates how many ARP requests the LES has forwarded to proxy devices.

`Unknown Control In` Indicates how many unknown control requests the LES has received.

A.4.3.6 Displaying the Information in a PowerCell LES

If you have configured a LES on the PowerCell 700, you can display the information in the LES by issuing the following command:

`les-showmember|lesm` *`<elan-name>`***`|all`** *`<slot>`***`|all`**

where:

*`<elan-name>`***`|all`**

Is the name of the ELAN that the LES or colocated LES/BUS pair serves. If you specify **`all`**, the contents of all the LESs on the PowerCell 700 in the specified slot are displayed.

*`<slot>`***`|all`** Is the chassis slot that contains the PowerCell 700. The slots are labeled on the PowerHub 700 chassis. You also can determine the slot number using the **`mgmt showcfg`** command. If you specify **`all`**, the contents of all the LESs on all PowerCell 700 Modules in the PowerHub chassis are displayed.

> **NOTE**: This command displays information only for LESs configured on the PowerHub 7000. To display statistics for a LES configured on an ATM switch or ATM adapter card, use the appropriate commands on that switch or adapter card.

Here are some examples of this command.

```
4:PowerHub:atm# les-showmembers engineering 1

ELAN Name: "elan1"
  LES: 99.9999.99.999999.9999.9999.9999.0000ef043480.10
  BUS: 99.9999.99.999999.9999.9999.9999.0000ef043480.10
  LAN Type: Ethernet/IEEE 802.3     Maximum Data Frame Size: 1516
  Non-proxy Control Distribute VCC: -.-
      Proxy Control Distribute VCC: 75.0

LEC #1 at 99.9999.99.999999.9999.9999.9999.0000ef043480.01 (proxy)
  00:00:ef:04:34:80 -> 99.9999.99.999999.9999.9999.9999.0000ef043480.01
  Control Direct VCC: 74.0
```

The fields in this display show the following information:

`ELAN Name` Indicates the name of the ELAN served by the LES.

`LES` Indicates the ATM address of the LES.

`BUS` Indicates the ATM address of the BUS.

`LAN Type` Indicates the LAN type of the devices in the ELAN. The LAN type is always 802.3 Ethernet.

`Maximum Data Frame Size`

Indicates the maximum frame size for data transmitted to the ELAN. The maximum frame size is 1516 bytes.

`Non-proxy Control Distribute VCC`

For hosts that are LECs, indicates the Control Distribute VCC (Virtual Channel Connection).

`Proxy Control Distribute VCC`

Lists the Control Distribute VCC (Virtual Channel Connection) in use by the PowerCell module, and all other proxy devices, for the ELAN served by the LES.

A.4.3.7 Deleting a LES from the PowerCell 700

To delete a LES that you have configured on the PowerCell 700, issue the following command:

`les-del|ledel` *`<elan-name> <slot>`*

<elan-name>	Is the name of the ELAN that the LES serves.
<slot>	Is the chassis slot that contains the PowerCell 700. The slots are labeled on the PowerHub 700 chassis. You also can determine the slot number using the **`mgmt showcfg`** command.

> **NOTE**: If the LES name you specify is for a colocated LES/BUS, the colocated LES/BUS is deleted.

A.4.3.8 Configuring a BUS on the PowerCell 700

To configure a BUS (but not a colocated LES/BUS) on the PowerCell 700, issue the following command:

`atm bus-add|buadd` *`<elan-name> <slot> <bus-SELbyte>`*

where:

<elan-name>	Is the name of the ELAN that the BUS will serve. You can specify an alphanumeric name from 1 to 32 characters in length.
<slot>	Is the chassis slot that contains the PowerCell 700. The slots are labeled on the PowerHub 700 chassis. You also can determine the slot number using the **`mgmt showcfg`** command.
<bus-SELbyte>	Is the Selector byte of the BUS. The Selector byte is the final two hexadecimal digits in an NSAP ATM address. You can specify the hexadecimal digits alone or use “0x” to flag them. In either case, the software assumes that the digits are hexadecimal.

Here is an example of this command. In this example, a BUS is added to the PowerCell 700 in slot 1 for an ELAN named “MAGIC-BUS.” The Selector byte for the BUS is 20 (hexadecimal). In this example, the “0x” used to denote a hexadecimal address is omitted. The “0x” is optional.

```
4:PowerHub:atm# bus-add MAGIC-BUS 1 20
```

A.4.3.9 Displaying BUS Statistics

To display BUS statistics for a BUS configured on the PowerCell 700, issue the following command.

bus-stats|bust *<elan-name>***|all** *<slot>***|all**

where:

*<elan-name>***|all**

Is the name of the ELAN that the BUS serves. If you specify **all**, statistics for all the BUSs on the PowerCell 700 in the specified slot are displayed.

*<slot>***|all** Is the chassis slot that contains the PowerCell 700. The slots are labeled on the PowerHub 700 chassis. You also can determine the slot number using the **mgmt showcfg** command. If you specify **all**, statistics for all the BUSs on all PowerCell 700 Modules in the PowerHub chassis are displayed.

> **NOTE**: This command displays information only for BUSs configured on the PowerHub 7000. To display statistics for a BUS configured on an ATM switch or ATM adapter card, use the appropriate commands on that switch or adapter card.

Here are some examples of this command.

```
4:PowerHub:atm# bus-stats engineering 1
BUS Statistics For ELAN: elan1

---------------------------------------------------------------------------
Unicast Data In    :          2
Multicast Data In  :          2
Known Control In   :          0
Unknown Control In :          1
```

The fields in this display show the following information:

`Unicast Data In` Indicates how many packets of unicast data the BUS for ELAN1 has received.

`Multicast Data In` Indicates how many packets of multicast data the BUS has received.

`Known Control In` Indicates how many control packets of a known type the BUS has received.

`Unknown Control In` Indicates how many control packets of an unknown type the BUS has received.

A.4.3.10 Deleting a BUS from the PowerCell 700

To delete a BUS that you have configured on the PowerCell 700, issue the following command:

bus-del|budel *<elan-name> <slot>*

<elan-name> Is the name of the ELAN that the BUS serves.

<slot> Is the chassis slot that contains the PowerCell 700. The slots are labeled on the PowerHub 700 chassis. You also can determine the slot number using the **mgmt showcfg** command.

A.4.3.11 Displaying the LES and BUS Configuration on the PowerCell 700

After you configure a LES, a BUS, or a colocated LES/BUS on the PowerCell 700, you can display the configuration by issuing the following command:

service-show|sescf *<elan-name>***|all** *<slot>***|all [les|bus]**

where:

*<elan-name>***|all**

Is the name of the ELAN that the LES, BUS, or colocated LES/BUS pair serves. If you specify **all**, configuration information about all the LESs, BUSs, and colocated LES/BUSs on the PowerCell 700 in the specified slot is displayed.

*<slot>***|all** Is the chassis slot that contains the PowerCell 700. The slots are labeled on the PowerHub 700 chassis. You also can determine the slot number using the **mgmt showcfg** command. If you specify **all**, configuration information about all the LESs, BUSs, and colocated LES/BUSs on all PowerCell 700 Modules in the PowerHub chassis is displayed.

les|bus Restricts the display to LESs only or BUSs only.

Here are some examples of the information displayed by this command. In the first example, summary information for all the LES and BUS services configured on the PowerCell 700 in slot 1 is displayed.

```
4:PowerHub:atm# service-show all 1
     Services on slot 1
     Slot  Name             Service Type       SEL
     ----  ----             ------------       ---
     1     engineering      LES                0x10
     1     engineering      BUS                0x20
     1     marketing        LES                0x30
     1     sales            Colocated LES/BUS  0x40
```

The fields in this display show the following information:

`Slot` Indicates the PowerHub slot that contains the PowerCell 700 on which the listed service is configured.

`Name` Indicates the name of the ELAN served by the LES or BUS.

`Service Type`	Indicates the service type. The service can be a BUS, a LES, or a colocated LES/BUS.
`SEL`	Indicates the Selector byte of the LES, BUS, or colocated LES/BUS.

In the following example, detailed information for a specific LES (for the ELAN "engineering") is displayed. Detailed information is displayed only when you request information about a specific service. If you request information for more than one service, summary information is displayed.

```
4:PowerHub:atm# service-show engineering 1 les
LES Configuration for: engineering

---------------------------------------------------------------------------
LES ATM Address : 99:9999:9999:9999:9999:9999:9999:0000ef043480:10
BUS ATM Address : 99:9999:9999:9999:9999:9999:9999:0000ef043480:10
Proxy Party Count    : 1
Proxy PMP VPI        : 0
Proxy PMP VCI        : 75
Non-Proxy Party Count: 0
Non-Proxy PMP VPI    : 0
Non-Proxy PMP VCI    : 0
```

The fields in this display show the following information:

`Proxy Party Count`	Indicates how many ATM hosts that are proxies are served by the LES.
`Proxy PMP VPI`	For proxy hosts, shows the PMP (Point-to-Multipoint) VPI (Virtual Path Identifier) the LES is using.
`Proxy PMP VCI`	For proxy hosts, shows the PMP (Point-to-Multipoint) VCI (Virtual Channel Identifier) the LES is using.
`Non-Proxy Party Count`	Indicates how many ATM hosts that are not proxies are served by the LES.
`Non-Proxy PMP VPI`	For non-proxy hosts, shows the PMP (Point-to-Multipoint) VPI (Virtual Path Identifier) the LES is using.
`Non-Proxy PMP VCI`	For non-proxy hosts, shows the PMP (Point-to-Multipoint) VCI (Virtual Channel Identifier) the LES is using.

Here is an example of the configuration information displayed for a BUS.

```
4:PowerHub:atm# service-show MAGIC-BUS 1 bus
BUS Configuration for: eng-BUS

---------------------------------------------------------------------------
BUS ATM Address : 99:9999:9999:9999:9999:9999:9999:0000ef043480:10
BUS PARTY COUNT : 1
BUS PMP VPI     : 0
BUS PMP VCI     : 79
```

The fields in this display show the following information:

`BUS ATM Address`	Indicates the ATM address of the BUS.
`BUS Party Count`	Indicates how many ATM hosts that are proxies are served by the BUS.
`BUS PMP VPI`	Shows the PMP (Point-to-Multipoint) VPI (Virtual Path Identifier) the BUS is using.
`BUS PMP VCI`	Shows the PMP (Point-to-Multipoint) VCI (Virtual Channel Identifier) the BUS is using.

A.4.3.12 Configuring the ATM Module as a LEC

FORE Systems recommends that you use the **`elan-configure`** command to add ELANs to the PowerCell module and to configure the LEC (LAN Emulation Client) on the slot. The **`elan-configure`** command eliminates the need to type two commands in order to create and enable an ELAN, and allows you to add an ELAN without having to disable and then re-enable the LEC.

However, as long as you do not use the **`elan-configure`** command to add the ELAN, you can use the **`lec-set`** command to configure the PowerCell module as a LEC. To configure the PowerCell module as a LEC, issue the following command:

lec-set|lse *<slot>***|all** *<param> <value>*
    [*<param> <value>***...[***<param> <value>***]]**

where:

*<slot>***|all** Specifies the NIM slot that contains the PowerCell module The PowerCell module runs one instance of the LANE 1.0 LEC. The LEC serves all the LANE 1.0 segments on the module. The NIM slots are labeled on the PowerHub chassis. You also can determine the slot number using the **mgmt showcfg** command.

<param> <value> Specifies the LEC parameter and the value you are assigning to the parameter. You can specify one of the following parameters:

lecs-usage|lu enl|dis [*<lecs-atm-address>***]**

Enables or disables the use of LECS by the LE Client of the specified slot.

If you specify the LECS address, separate each portion of the address with a period (**.**), a colon (**:**), or a hyphen (**-**).

If you do not specify the LECS ATM address, the well-known address is used. If you specify **dis** (disabled), the LECS (LAN Emulation Configuration Server) is not used.

> **NOTE**: To specify the well-known LECS address, enter the following:
>
> **47:0079:0000:0000:0000:0000:0000:00a03e000001:00**
>
> When you enable LECS usage on the PowerCell module, all ELANs use the LECS to obtain the LES address, even if you explicitly specified a LES address when you add an individual ELAN. If you specified a LES address when you added ELANs, do not enable LECS usage.

state|s enl|dis

Enables or disables the LEC on the PowerCell module in the specified slot.

A.4.3.13 Displaying LEC Configuration Information

To display LEC configuration information for the PowerCell module, issue the following command:

lec-showcfg|lscf *<slot>***|all**

where:

*<slot>***|all** Specifies the NIM slot that contains the PowerCell module. The NIM slots are labeled on the PowerHub chassis. You also can determine the slot number using the **mgmt showcfg** command. If you specify **all**, LEC configuration information is displayed for all the PowerCell modules in the chassis.

Here is an example of the information displayed by this command. The “LE Client” is the LEC (PowerCell module).

```
5:PowerHub:atm# lec-showcfg 4
LEC Configuration For slot: 4
---------------------------------------------------------------------------
LE Client State       : Enabled
LE Client ATM Address : 47:0005:80ff:e100:0000:f21a:1e3c:0000ef0282d0:00
LECS ATM Address      : 47:0079:0000:0000:0000:0000:0000:00a03e000001:00
```

The fields in this display show the following information:

`LE Client State` Indicates whether the PowerCell module is enabled as a LEC (LAN Emulation Client).

`LE Client ATM Address`	Indicates the ATM address of the PowerCell module. The address displayed is the base address of the LEC (PowerCell module). The Selector byte contains zeroes (00). Each ELAN configured on the PowerCell module uses the base address but has a unique value in the Selector byte.
`LECS ATM Address`	Indicates the ATM address of the LECS (LAN Emulation Configuration Server).

A.4.3.14 Displaying the LE_ARP Table for an ELAN

The PowerHub software maintains a separate LE_ARP (LAN Emulation Address Resolution Protocol) table for each ELAN on the PowerCell module. The LE_ARP table maps the MAC addresses of the devices in an ELAN to their corresponding ATM addresses.

To display the LE_ARP table for an ELAN, issue the following command:

`elan-arptable|eat` *`<elan-name>`***`|`***`<mac-address>`***`|all`**

where:

*`<elan-name>`***`|`***`<mac-address>`***`|all`**

Specifies an ELAN name or MAC address. If you specify **`all`**, LE_ARP table entries for all the ELANs on all the PowerCell modules in the PowerHub chassis are displayed.

Here are some examples of the information displayed by this command. In the following example, the LE_ARP table entries for “elan1” are displayed.

```
5:PowerHub:atm# elan-arptable elan1

ARP Table For ELAN: elan1

 Seg. MAC Address         ATM Address
---------------------------------------------------------------------------
  19  00-20-48-1a-1e-3c   47:0005:80ff:e100:0000:f21a:1e3c:0020481a1e3c:10
  19  ff-ff-ff-ff-ff-ff   47:0005:80ff:e100:0000:f21a:1e3c:0020481a1e3c:02
```

In the following example, a MAC address is specified. The ELAN name and ATM address corresponding to the MAC address are listed.

```
6:PowerHub:atm# elan-arptable 00-20-48-1a-1e-3c

ARP Table For MAC Address: 00-20-48-1a-1e-3c

 Seg. Elan Name             ATM Address
 ---------------------------------------------------------------------------
  19  elan1                 47:0005:80ff:e100:0000:f21a:1e3c:0020481a1e3c:10
```

The fields in these displays show the following information:

`Seg`	Indicates the PowerHub segment on which the ELAN is configured.
`MAC Address`	Indicates the MAC address of a LANE 1.0 device.
`ELAN Name`	Indicates the name of the ELAN.
`ATM Address`	Indicates the ATM address of a LANE 1.0 device.

A.4.3.15 Clearing an ELAN's LE_ARP Table

To clear an ELAN's LE_ARP table, issue the following command:

elan-arptableclear|eatc *<elan-name>***|all**

where:

*<elan-name>***|all**	Specifies the name of the ELAN for which you want to clear the LE_ARP table. If you specify **all**, the ARP tables for all the ELANs on all PowerCell modules in the PowerHub chassis are cleared.

A.4.3.16 Displaying the Virtual Circuits on an ELAN

To display the VCs (Virtual Circuits) in use on an ELAN, issue the following command:

elan-vctable|evt *<elan-name>***|all**

where:

*<elan-name>***|all**	Specifies the name of the ELAN for which you want to display the VC table. If you specify **all**, the active VCs on all the ELANs on all PowerCell modules in the PowerHub chassis are displayed.

Here is an example of the information displayed by this command. In this example, the VC for "elan1" is displayed.

```
7:PowerHub:atm# elan-vctable elan1

VC Table For ELAN: elan1

 Seg. MAC Address         VC    LEC-ID
---------------------------------------------------------------------------
  19  00-20-48-1a-1e-3c    67     7
```

The fields in this display show the following information:

`Seg`	Indicates the PowerHub segment on which the ELAN is configured.
`MAC Address`	Indicates the MAC address of the device at the other end of the VC (Virtual Circuit).

`VC`	Indicates the number of the VC (Virtual Circuit) connecting the ELAN on the PowerCell module to the other device. The VC number is negotiated by the PowerCell module and the ATM switch when the VC is established. The VC number can be different for each VC.
`LEC-ID`	Indicates the PowerCell LEC ID of the ELAN. The PowerCell LEC ID is local. The LEC ID of the same ELAN can be different on other devices. Each ELAN on the PowerCell module can have a different LEC ID.

A.4.3.17 Displaying Statistics

The PowerCell module collects statistics for the data traffic and the control traffic sent and received by the ELANs configured on the PowerCell module. All statistics are collected on a per-ELAN basis.

- Statistics for data traffic are collected as interface statistics because the ELAN data packets are processed on the interface layer.
- Statistics for ATM control traffic are collected as ELAN statistics because they are processed on the ELAN layer.

To display ATM statistics, issue the following command:

elan-stats|est *<elan-name>***|all elan|if|all**

where:

*<elan-name>***|all**	Specifies the name of the ELAN for which you want to display statistics. If you specify **all**, statistics for all the ELANs in the PowerHub system are displayed.	
elan|if|all	Specifies the type of statistics you want to display:	
	elan	Displays ELAN (control) statistics.
	if	Displays interface (data) statistics.
	all	Displays ELAN statistics and interface statistics.

Here is an example of the interface statistics displayed by this command. In this example and the following example, the statistics are displayed for an ELAN named "elan1."[2]

2. The statistics displayed by the **elan-stats** command include FDDI traffic forwarded by the PowerCell module to the ATM network. However, the Packet Engine internally translates FDDI packets into Ethernet packets before forwarding them to intelligent NIMs such as the PowerCell module. In this way, the PowerCell module adheres to the LANE 1.0 standard while still translating traffic between your FDDI and ATM networks.

```
8:PowerHub:atm# elan-stats elan1 if

Interface Statistics For ELAN: elan1

---------------------------------------------------------------------------
Out MCast Pkts    :          1
Out Errors        :          0
Out Discard       :          0
Out UCast Pkts    :          1
In MCast Pkts     :          0
In Errors         :          0
In Discard        :          0
In UCast Pkts     :          0
In Unknown Protos :          0
MTU size          :       1514
```

The fields in this display show the following information:

`Out MCast Pkts`	Indicates the number of Ethernet broadcast or multicast packets the ELAN has sent to the ATM network.
`Out Errors`	Indicates the number of Ethernet packets sent by the ELAN that experienced an error during transmission.
`Out Discard`	Indicates the number of Ethernet packets that were discarded due to an error on the PowerCell module, rather than sent to the ATM network.
`Out UCast Pkts`	Indicates the number of Ethernet unicast packets the ELAN has sent to the ATM network.
`In MCast Pkts`	Indicates the number of Ethernet broadcast or multicast packets the ELAN has received from the ATM network.
`In Errors`	Indicates the number of Ethernet packets received by the ELAN that contain errors.
`In Discard`	Indicates the number of Ethernet packets that were discarded due to an error in the PowerCell module, rather than received for the ELAN.
`In UCast Pkts`	Indicates the number of Ethernet unicast packets the ELAN has received from the ATM network.
`In Unknown Protos Pkts`	Indicates the number of Ethernet packets received that were using an unknown protocol.
`MTU size`	Indicates the MTU (maximum transmission unit) for the protocol being used in the ELAN. For Ethernet, the MTU is 1514 bytes.[3]

Here is an example of the ELAN statistics displayed for an ELAN.

```
9:PowerHub:atm# elan-stats elan1 elan

ELAN Statistics For ELAN: elan1

---------------------------------------------------------------------------
SVCs Released     :          1
Total Control In  :          5
Total Control Out :          5
ARP Replies In    :          2
ARP Replies Out   :          0
ARP Request In    :          0
ARP Request Out   :          2
Join ELAN Calls   :          1
```

The fields in this display show the following information:

`SVCs Released`	Indicates the number of SVCs (Switched Virtual Circuits) that have been released (torn down) by this ELAN. An SVC is released after the two ends of the SVC (the ELAN on the PowerCell module and the device on the other end) stop exchanging traffic.
`Total Control In`	Indicates the number of LANE 1.0 control packets received on this ELAN by the PowerCell module.
`Total Control Out`	Indicates the number of LANE 1.0 control packets sent on this ELAN by the PowerCell module.
`ARP Replies In`	Indicates the number of LE_ARP replies received on this ELAN by the PowerCell module.
`ARP Replies Out`	Indicates the number of LE_ARP replies sent on this ELAN by the PowerCell module.
`ARP Request In`	Indicates the number of LE_ARP requests received on this ELAN by the PowerCell module.
`ARP Request Out`	Indicates the number of LE_ARP requests sent on this ELAN by the PowerCell module.
`Join ELAN Calls`	Indicates the number of times an ELAN on the PowerCell module has requested to join the like-named ELAN configured on the ATM switch.

3. This does not include the 4-byte CRC added to the packet by the Ethernet chip.

A.4.3.18 Clearing Statistics

To clear ATM statistics, issue the following command:

elan-statsclear|estc *<elan-name>***|all**

where:

*<elan-name>***|all** Specifies the name of the ELAN for which you want to clear statistics. If you specify **all**, statistics for all the ELANs in the PowerHub system are cleared.

A.4.3.19 Displaying ELAN Parameters

You can display the ELAN parameters configured on the PowerCell module by issuing the **elan-showcfg** command. The ELAN parameters can be set on a per-ELAN basis. The PowerCell module uses the same settings for all ELANs by default, but you can change the settings for individual ELANs or all ELANs by using the **elan-set** command. (See Section A.4.3.20 on page 149.)

Here is the syntax for the **elan-showcfg** command:

elan-showcfg|escf *<elan-name>***|all**

where:

*<elan-name>***|all** Specifies the name of the ELAN for which you want to display ELAN parameters. If you specify **all**, the ELAN parameters are displayed for all the ELANs configured on the PowerHub system.

Here is an example of the information displayed by this command. In this example, configuration information is displayed for an ELAN named “elan1.”

```
10:PowerHub:atm# elan-showcfg elan1
Configuration For ELAN: elan1

---------------------------------------------------------------------------
Segment        :    19
Max ARP Retry  :     2
ARP Aging Time :   300 (sec)
Control Timeout:   120 (sec)
Flush Timeout  :     6 (sec)
Forward Delay  :    15 (sec)
VCC Timeout    :    20 (min)
BUS Rate       :     1 (pps)

LES Address    : 47:0005:80ff:e100:0000:f21a:1e3c:0020481a1e3c:01
BUS Address    : 47:0005:80ff:e100:0000:f21a:1e3c:0020481a1e3c:02

LECS Configuration VCC :            65
LES Control Direct VCC :            66
LES Control Distribute PMP VCC :    67
BUS Multicast Send VCC :            68
BUS Multicast Forward PMP VCC :     69
```

In addition to the LES address and BUS address, this command displays the following information:

`ELAN State`
: The state of the ELAN. The ELAN can be in one of the following states:

- `Operational`
- `Initial State`
- `Waiting for Connection to LECS`
- `Waiting for ATM Address Assignment`
- `Waiting for LECS Reply`
- `Waiting LES Connect Back`
- `Sending Join/Bus ARP/Register Requests to LES`
- `Waiting for Connection to BUS`
- `ELAN Suspended`

The `Operational` state indicates that the ELAN is functioning normally. The other states occur briefly when you start the LEC. If the state does not change to `Operational` after a few seconds, there might be a problem with the LANE 1.0 configuration. For example, if the state remains `Initial State`, the LEC might be disabled.

`Segment`
: Indicates the PowerHub segment on which the ELAN is configured.

`MAX ARP Retry`
: Indicates the number of times the ELAN will send an LE_ARP Request for a given frame's LAN destination if a reply is not received the first time the PowerCell module sends the LE_ARP request.

`ARP Aging Time`
: Indicates the maximum number of seconds that the PowerCell module will maintain an entry in the ELAN's LE_ARP cache after receiving a packet from the source address in the cache entry.

If Topology Change is true, the forward delay is used to age LE_ARP entries, instead of the ARP aging time. (See the description of the `Forward Delay` field.)

`Control Timeout`
: Indicates how many seconds the ELAN will wait for a response to a control-frame request.

`Flush Timeout`	Indicates how many seconds the ELAN will wait to receive a response to a request to flush the BUS.
`Forward Delay`	Indicates how many seconds the PowerCell module will maintain an entry in the ELAN's LE_ARP cache following verification of the entry, as long as Topology Change is true. Topology Change is true when Topology Change frames notify LECs (including the PowerCell 700) that the LECs' cached LE_ARP entries might be incorrect. When Topology Change is true, the forward delay timer is used in place of the ARP aging time to age LE_ARP entries.
`VCC Timeout`	Indicates how many minutes the PowerCell module will maintain a Data Direct VCC that is idle before closing the VCC.
`BUS Rate`	Indicates the rate (in Packets Per Second) at which the ELAN can send unknown packets to the BUS. An unknown packet is a packet whose destination's ATM address is unknown to the ELAN.
`LECS Configuration Direct VCC`	The number that identifies the Configuration Direct VCC that connects the PowerHub system (the LEC) to the LECS. This type of virtual circuit provides configuration information to the LEC as it comes on-line in the network.
`LES Control Direct VCC`	The number that identifies the bidirectional Control Direct VCC that connects the LES and the PowerHub system (the LEC). This type of VCC carries management traffic to and from the LES.
`LES Control Distribute PMP VCC`	The number that identifies the unidirectional, Control Distribute PMP (point-to-multipoint) VCC opened from the LES to the PowerHub system (the LEC). This type of VCC carries management traffic from the LES to the LEC.
`BUS Multicast Send VCC`	The number that identifies the bidirectional, point-to-point Multicast Send VCC between the BUS (Broadcast Unknown Server) and the PowerHub system (the LEC). This VCC carries multicast and initial unknown unicast traffic between the BUS and the LEC.

`BUS Multicast Forward VCC`

The number that identifies the Multicast Forward VCC between the BUS and the PowerHub system (the LEC). This VCC is set up after the Multicast Send VCC. The BUS Multicast Forward VCC can be either point-to-multipoint or unicast point-to-point, and it carries data from the BUS to the LEC.

A.4.3.20 Changing ELAN Parameters

Use the **`elan-set`** command to change the default for an ELAN parameter. You can display the current settings for each parameter using the **`elan-showcfg`** command. See Section A.4.3.13 on page 140 for information about this command and for descriptions of the ATM parameters.

The LECS configuration file on the FORE ATM switch contains parameters similar to the ELAN parameters maintained by the PowerCell module. Most of the PowerCell defaults for the parameters match the defaults for the FORE LECS equivalents to these parameters. FORE Systems recommends that you use the defaults for these values. If you change the value of an ELAN parameter in the LECS configuration file, we recommend that you also change the value of the parameter on the PowerCell module.

Here is the syntax for the **`elan-set`** command.

`elan-set|ese` *<elan-name>***`|all`** *<param> <value>*
`[`*<param> <value>***`...[`***<param> <value>***`]]`**

where:

*<elan-name>***`|all`** Specifies the name of the ELAN for which you want to set ELAN parameters. If you specify **`all`**, the parameters you configure are applied to all the ELANs in the PowerHub system.

<param> <value> Specifies the ELAN parameter and the value you are assigning to the parameter. You can specify one of the following parameters:

`arp-aging|aa` *<seconds>*

You can specify from **`10`** through **`300`** seconds. The default is **`300`**.

The corresponding parameter in the LECS file is `.Aging_Time`.

`bus-rate|br` *<packets-per-second>*

You can specify from **`0`** through **`10`** Packets Per Second. The default is **`1`**.

The corresponding parameter in the LECS file is `.Maximum_Unknown_Frame_Time`.

control-timeout|cto *<seconds>*

You can specify from **10** through **600** seconds. The default is **120**.

The corresponding parameter in the LECS file is `.Control_TimeOut`.

flush-timeout|fto *<seconds>*

You can specify from **1** through **10** seconds. The default is **6**.

The corresponding parameter in the LECS file is `.Flush_TimeOut`.

forward-delay|fd *<seconds>*

You can specify from **4** through **30** seconds. The default is **15**.

The corresponding parameter in the LECS file is `.Forward_Delay_Time`.

max-arp-retry|mar *<count>*

You can specify from **0** through **2** requests. The default is **2**.

The corresponding parameter in the LECS file is `.Maximum_Retry_Count`.

vcc-timeout|vto *<minutes>*

You can specify from **1** through **720** minutes. The default is **20**.

The corresponding parameter in the LECS file is `.VCC_TimeOut_Period`.

A.4.4 RFC-1483 Encapsulation Commands

The commands in this section let you configure PowerCell segments for use with RFC-1483 Encapsulation.

A.4.4.1 Configuring a Segment for RFC-1483 Encapsulation

Before enabling RFC-1483 Encapsulation on a segment, you must first configure the PowerCell segment to use PVC Bridging using the **atm segment-set** command. (See Section 2.10.1 on page 44 for more information on the **atm segment-set** command.)

After you configure a PowerCell segment to use RFC-1483 Encapsulation, you can enable RFC-1483 Encapsulation on the segment. To enable RFC-1483 Encapsulation on a PowerCell segment, issue the following command:

br-encap-set|bse *<segment>* **[** *<param> <value>*
<param> <value>... **] state|s enl|dis**

where:

<segment> Specifies the PowerCell segment you are configuring for RFC-1483 Encapsulation.

<param> <value> Specifies the RFC-1483 Encapsulation parameter and the value you are assigning to the parameter. You can specify the following parameters and values:

in-pvc|ip *<vci>*

Specifies the incoming PVC's VCI (Virtual Circuit ID).

out-pvc|op *<vci>*

Specifies the outgoing PVC's VCI (Virtual Circuit ID).

state|s enl|dis The **state** parameter enables or disables RFC-1483 Encapsulation on the segments you specified. The default is **dis** (disabled).

Here is an example of this command. In this example, Classical IP over ATM is enabled on PowerHub segment 25. Outgoing VCI 182 and incoming VCI 181 are assigned to the segment.

```
10:PowerHub:atm# br-encap-set 25 in-pvc 182 out-pvc 181 state enl
Okay
```

A.4.4.2 Displaying the RFC-1483 Encapsulation Configuration and Statistics

You can display the incoming and outgoing VCI (Virtual Channel IDs) and packet statistics for a PowerCell segment that is enabled for RFC-1483 Encapsulation.

To display the RFC-1483 Encapsulation information for a segment, issue the following command:

br-encap-showcfg|bscf *<segment>***|all**

where:

*<segment>***|all**	Specifies the PowerCell segment(s) for which you want to display the PVC configuration and statistics. You can specify a single segment number or all segments. If you specify **`all`**, PVC information is displayed for all the PowerCell segments in the chassis on which RFC-1483 Encapsulation is enabled.

Here is an example of this command. In this example, PVC information is displayed for segment 25.

```
10:PowerHub:atm# br-encap-showcfg 25
RFC-1483 encapsulation information for segment 25
    In PVC VCI:                      182
    Out PVC VCI:                     181

    Total Pkts sent:                 25
    Total Pkts rcvd:                 322
    Pkts rcvd with unknown type:     0
    Pkts rcvd with unknown protocol: 0
    Pkts rcvd with length too big:   0
```

The fields in this display show the following information:

`In PVC VCI`	Indicates the incoming VC ID for the segment.
`Out PVC VCI`	Indicates the outgoing VC ID for the segment.
`Total Pkts sent`	Indicates the total number of packets sent on the segment.
`Total Pkts rcvd`	Indicates the total number of packets received on the segment.
`Pkts rcvd with unknown type`	Indicates the total number of packets received by the segment that had an unknown type.
`Pkts rcvd with unknown protocol`	Indicates the total number of packets received by the segment that had an unknown protocol.
`Pkts rcvd with length too big`	Indicates the total number of packets received by the segment that exceeded the maximum packet length.

A.4.5 Classical IP Commands

The commands in this section let you configure PowerCell segments for use with Classical IP over ATM.

A.4.5.1 Configuring a Segment for Classical IP

Before you enable a segment to use Classical IP routing in an ATM network, you must set the ATM protocol type to CLIP and configure an IP interface on the segment. (See Section 2.10 and Section 2.13 for information on how to set the ATM protocol type and configure the IP interface.)

After you configure the PowerCell segment to use Classical IP over ATM, you can:

- Specify the ATM address of the ATM ARP server. (You must do this before you enable Classical IP on the segment.)
- Enable Classical IP on the segment.

To perform these tasks, use the **clip-set** command. Here is the syntax for this command:

clip-set|clse *<segment> <param> <value>*
[*<param> <value>...* **]**

where:

<segment>	Specifies the PowerCell segment you are configuring for Classical IP.
<param> <value>	Specifies the Classical IP parameter and the value you are assigning to the parameter. You can specify the following parameters and values:
	atmarp-svr|as *<arpsvr-atm-address>*
	Specifies the ATM address of the ATM ARP server. Specify the address in NSAP (Network Service Access Point) format.
	state|s enl|dis
	Enables or disables the segment for Classical IP routing.
	The default is **dis** (disabled).

Here are some examples of the **clip-set** command:

```
10:PowerHub:atm# clse 22 as
 45.0005.80.ffe100.0000.f215.1490.00-00-ef-01-ab-cd.04 s enl
Enable CLIP segment

11:PowerHub:atm#
```

To remove CLIP from a segment, you disable the segment using the **clip-set** command and then remove the protocol form the segment using the **atm segment-set** command. The **clip-set** command is described in Section 5.2.2. The **atm segment-set** command is described in Section 2.10.1 on page 44.

Here are some examples of the commands used to disable a CLIP segment. The first command disables the segment and removes it from use, and the second command removes the CLIP protocol from the segment. In this example, the terse form of the **clip-set** and **atm segment-set** commands are used. Note that when you disable a segment, it is not necessary to specify the ARP server on the LIS.

```
12:PowerHub:atm#clse 22 s dis

13:PowerHub:atm#sse 22 s n
```

A.4.5.2 Displaying the Classical IP Configuration

To verify the Classical IP configuration of a PowerCell segment, issue the following command:

clip-showcfg|clsh *<segment>***|all**

where:

*<segment>***|all** Specifies the PowerCell segment(s) for which you want to display the Classical IP configuration. You can specify a single segment number, a comma-separated list of segments, or a hyphen-separated range of segments. If you specify **all**, configuration information is displayed for all the PowerCell segments in the chassis that are configured for Classical IP.

Here is an example of this command.

```
10:PowerHub:atm# clip-showcfg 22
Show remote config for segment 22
Displaying information from the ATM card for segment22
Classical-IP-over-ATM Configuration segment 22
-------------------------------------------------------------------
IP address:             111.22.33.4
Interface ATM Address:  47.0005.80.ffe100.0000.f215.1490.00-00-ef-01-cd-ba.06
ATM ARP Svr Addr:       45.0005.80.ffe100.0000.f215.1490.00-00-ef-01-ab-cd.04
Admin Status:           Enabled
Physical State:         Up
Oper. State:            Running (SVC Mode)
IP/IF Stats:            IP/IF configured
Arp Age (secs):         1200000
Arp conn timout (secs)  1200000
```

The fields in this display show the following information:

`ATM ARP Svr Addr` Displays the ATM address of the ATM ARP server for the LIS.

A.4.5.3 Displaying the Classical IP ARP Entries and VCs

The **`clip-arp-table`** command displays a list of the active VCs and ATM ARP addresses associated with an LIS. Here is the syntax for this command:

`clip-arp-table|clat` *<segment>***`|all`** *<ipaddr>***`|all`**

where:

*<segment>***`|all`**	Specifies the PowerCell segment(s) for which you want to display the active VCs and ATM ARP addresses. You can associate a Classical IP LIS with a single PowerCell segment. Therefore, by specifying the segment number, you are specifying a particular LIS. You can specify a single segment number, a comma-separated list of segments, or a hyphen-separated range of segments. If you specify **`all`**, the active VCs and ATM ARP entries for all segments using Classical IP are displayed.
*<ipaddr>***`|all`**	Specifies the IP address of the segment(s) for which you want to display the active VCs and ATM ARP addresses.

The fields in this display show the following information:

`IP Addr`	Displays the IP address of the node.
`Out VC`	Displays the number of the outgoing VC to the node.
`ATM Address`	Displays the ATM address of the node.

A.4.5.4 Clearing the Classical IP ARP Entries and VCs

To clear the active VCs and ATM ARP addresses from the PowerCell module(s), issue the following command:

`clip-arptable-clear|clac`

After you clear the entries, the PowerHub system begins accumulating new entries.

A.4.5.5 Displaying Classical IP Statistics

To display Classical IP statistics for a PowerCell segment, issue the following command:

`clip-stats|clst` *<segment>***`|all`**

where:

*<segment>***`|all`**	Specifies the PowerCell segment(s) for which you want to display Classical IP statistics. You can specify a single segment number, a comma-separated list of segments, or a hyphen-separated range of segments. If you specify **`all`**, statistics are displayed for all the PowerCell segments in the chassis that are configured for Classical IP.

Here is an example of this command.

```
10:PowerHub:atm# clip-stats 22
Classical IP Statistics for Interface 147.128.10.1 on segment 22
-------------------------------------------------------------------
In UCast Pkts:        347789
In Mcast Pkts:        233
Out UCast Pkts:       4172
Out Mcast Pkts:       499
In Errors:            2
In Discard:           23
Out Pkts Dropped:     311
Out ARP Req:          45
In ARP Req:           3
In InARP Req:         2
In ARP Rep:           41
Out ARP Rep:          3
ARP Age Cnt:          48
```

The fields in this display show the following information:

`In UCast Pkts`	Indicates the number of unicast packets received on the PowerCell segment(s).
`In MCast Pkts`	Indicates the number of multicast packets received on the PowerCell segment(s).
`Out UCast Pkts`	Indicates the number of unicast packets sent on the PowerCell segment(s).
`Out MCast Pkts`	Indicates the number of multicast packets sent on the PowerCell segment(s).
`In Errors`	Indicates the number of packets containing errors received on the segment(s).
`In Discard`	Indicates the number of packets received on the segment(s) that were discarded by the PowerCell module.
`Out Pkts Dropped`	Indicates the number of outgoing packets that were dropped by the PowerCell module, rather than sent.
`Out ARP Req`	Indicates the number of ARP requests sent to the LIS ARP server on the segment.
`In ARP Req`	Indicates the number of ARP requests received from the LIS on the segment.
`In InARP Req`	Indicates the number of Inverse ARP requests received from the LIS ARP server on the segment.
`In ARP Rep`	Indicates the number of ARP replies received from the LIS on the segment.
`Out ARP Rep`	Indicates the number of ARP replies sent on the segment.

`ARP Age Cnt`	Indicates the number of ARP entries that the PowerCell software has aged out of the VC and ARP table.

A.4.5.6 Clearing Classical IP Statistics

To clear the Classical IP statistics for a segment, issue the following command:

`clip-stats-clear|clsc` *<segment>***`|all`**

After you clear the Classical IP statistics, the PowerCell module begins accumulating new statistics.

A.4.6 FORE IP Commands

The commands in this section let you configure PowerCell segments for use with FORE IP.

NOTE: FORE IP is not supported on the PowerCell 600.

A.4.6.1 Enabling FORE IP on a Segment

Before enabling FORE IP on a segment, you must first configure the PowerCell segment to use FORE IP using the **atm segment-set** command. (See Section 2.10.1 on page 44 for more information on the **atm segment-set** command.)

After you configure a PowerCell segment and an ATM switch to use FORE IP, you can enable FORE IP on the segment. To enable FORE IP on a PowerCell segment, issue the following command:

foreip-set|fse *<segment> <param> <value>*

where:

<segment>	Specifies the PowerCell segment on which you are enabling FORE IP.
<param> <value>	Specifies the FORE IP parameter and the value you are assigning to the parameter. You can specify the following parameter: **state|s enl|dis** The **state** parameter enables or disables FORE IP on the segments you specified. The default is **dis** (disabled).

Here are some examples of this command. In the following example, FORE IP is enabled on segment 17.

```
10:PowerHub:atm# fore-ip set 17 state enl
```

In the following example, FORE IP is disabled on segment 17.

```
10:PowerHub:atm# fore-ip set 17 state dis
```

When FORE IP is disabled on the segment, the segment will display as disabled when you verify the PowerCell configuration using the **atm segment-showcfg** command. After you disable FORE IP, you can re-enable it, or assign another protocol to the segment using the **atm segment-set** command and configure the segment to use another protocol.

A.4.6.2 Displaying the Outbound Segment's Cache

The PowerHub FORE IP software maintains a cache of the outbound VCs (Virtual Circuits) for each PowerCell segment configured for FORE IP. The FORE IP cache maps the IP address of a switch or end station to its corresponding SPANS (Simple Protocol for ATM Network Signalling) address. The SPANS addresses displayed in the cache are always directly reachable by the PowerCell module; there is no intervening router. The IP addresses can be for local or remote switches or end stations reachable through the corresponding SPANS addresses.

To display the FORE IP cache for a PowerCell segment, issue the following command:

foreip-show-cache|fsoc *<segment>*

<segment> Specifies the PowerCell segment for which you are displaying the FORE IP cache.

Here is an example of the information displayed by this command. In this example, the FORE IP cache for segment 17 is displayed.

```
10:PowerHub:atm# foreip-show-cache 17
IP Address         Out VC    SPANS Address
----------         ------    -------------
134.163.20.3       121       00-00-00-01-f2-1a-23-bd
```

The FORE IP cache contains the following information:

`IP Address` Indicates the IP address of the switch or end station attached to the PowerCell segment.

`Out VC` Indicates the number of the outbound VC (Virtual Circuit). This VC is established by SPANS and is used by the PowerCell module to send FORE IP traffic from the PowerCell segment to the ATM switch or end station.

`SPANS Address` Indicates the SPANS address of the ATM switch or end station directly attached to the PowerCell segment.

In the following example, a single VC and SPANS address are associated with multiple IP addresses. This type of display is typical in configurations where multiple FORE IP end stations or ATM switches can be reached through the ATM switch attached to a PowerCell segment.

```
10:PowerHub:atm# foreip-show-cache 17
IP Address         Out VC    SPANS Address
----------         ------    -------------
134.163.20.3       121       00-00-00-01-f2-1a-23-bd
134.163.20.4       121       00-00-00-01-f2-1a-23-bd
134.163.20.5       121       00-00-00-01-f2-1a-23-bd
134.163.20.6       121       00-00-00-01-f2-1a-23-bd
```

In the example above, four different IP addresses can be reached through VC 121 and SPANS address 00-00-00-01-f2-1a-23-bd. The ATM switch associated with the SPANS address is locally attached. The IP addresses can be for the ATM switch or end station itself, or for other ATM switches or end stations that can be reached through the ATM switch associated with the SPANS address.

A.4.6.3 Displaying FORE IP Statistics

The PowerHub software maintains FORE IP statistics for each PowerCell segment enabled for FORE IP. To display the FORE IP statistics for a PowerCell segment, issue the following command:

foreip-statistics|fst *<segment>*

<segment>	Specifies the PowerCell segment for which you are displaying FORE IP statistics.

Here is an example of the information displayed by this command.

```
10:PowerHub:atm# foreip-statistics 17
FORE-IP packet statistics for segment 17
   Total Pkts sent:               394
   Total ARP Pkts sent to CLS:    5
   Total BMCAST Pkts sent to CLS: 0
   Total Unicast Pkts sent:       389
   Total Pkts received:           426
   Total ARP Pkts received:       5
   Total BMCAST Pkts received:    0
   Total Unicast received:        421
   Total Pkts dropped:            0
   Total Pkts not sent:           0
   Total Pkts forwarded to PE:    389
   Total Pkts with bad length:    0
```

The fields in this display show the following information:

`Total Pkts sent` Indicates the total number of FORE IP packets sent on this PowerCell segment.

`Total ARP Pkts sent to CLS`

Indicates the total number of FORE IP ARP packets sent by this PowerCell segment to the FORE IP CLS (Connectionless Server).

`Total BMCAST Pkts sent to CLS`

Indicates the total number of FORE IP broadcast or multicast packets sent by this PowerCell segment to the FORE IP CLS (Connectionless Server).

`Total Unicast Pkts sent` Indicates the total number of FORE IP unicast packets sent by this PowerCell segment.

`Total Pkts received` Indicates the total number of FORE IP packets received on this PowerCell segment.

`Total ARP Pkts received` Indicates the total number of FORE IP ARP packets received on this PowerCell segment from the FORE IP CLS (Connectionless Server).

`Total BMCAST Pkts received`

Indicates the total number of FORE IP broadcast or multicast packets received on this PowerCell segment from the FORE IP CLS (Connectionless Server).

`Total Unicast Pkts received`

Indicates the total number of FORE IP unicast packets received on this PowerCell segment.

`Total Pkts dropped` Indicates the total number of packets dropped by this PowerCell segment.

`Total Pkts not sent` Indicates the total number of packets that were not sent by this PowerCell segment.

`Total Pkts forwarded to PE`

Indicates the total number of FORE IP packets forwarded to the Packet Engine by this PowerCell segment. After receiving the packets from the PowerCell module, the Packet Engine discards or forwards the packets as needed.

`Total Pkts with bad length`

Indicates the total number of FORE IP packets that did not have the correct length.

A.4.6.4 Clearing FORE IP Statistics

To clear the FORE IP statistics for a segment, issue the following command:

`foreip-stats-clear|fstc` *<segment>*

After you clear the Classical IP statistics, the PowerCell module begins accumulating new statistics.

Appendix B: Intelligent-Module Commands

The PowerHub software contains a subsystem, the **ginim** subsystem, for commands related to intelligent modules including the PowerCell 700 and PowerCell 600. The **ginim** subsystem contains commands for performing the following tasks:

- Testing communication between the intelligent modules and the Packet Engine. (See Section 2.9 on page 38.)
- Displaying local-processing statistics. (See Section B.3 on page 164.)
- Clearing local-processing statistics. (See Section B.4 on page 167.)
- Changing the setting of the watchdog timer. (See Section B.5 on page 167.)

B.1 ACCESSING THE GINIM SUBSYSTEM

To access the **ginim** subsystem, issue the following command at any runtime prompt:

```
ginim
```

B.2 GINIM SUBSYSTEM COMMANDS

Table A–1 lists the **ginim** subsystem commands. For each command, the management capability is listed, as well as the section that contains more information about the command. (The management capability is explained in the “Getting Started with the User Interface” chapter in the *Installation and Configuration Manual* for your PowerHub system.)

TABLE A–1 GINIM subsystem commands.

Command and Description	Capability*	See…
`ginim-diag-check|gdc start|stop` Starts or stops the intelligent-module communication test.	R	2.9
`ginim-stats|gs` *<slot>* Displays local packet-processing statistics for the intelligent module in the specified slot.	R or M	B.3
`ginim-stats-clear|gsc` *<slot>* Clears local packet-processing statistics accumulated the intelligent module in the specified slot.	R or M	B.3
`set-ginim-watch-dog|sgwd` *<timer-value-in-seconds>* Changes the setting of the watchdog timer.	R	B.3
***R= Root, M=Monitor.**		

B.3 DISPLAYING LOCAL PACKET-PROCESSING STATISTICS

In addition to the standard Ethernet statistics available using the **`bridge stats`** command,[1] you can display local packet-processing statistics that apply specifically to intelligent modules such as the PowerCell 700 and PowerCell 600. The local packet-processing features are described in Section 1.3.3 on page 14.

To display local packet-processing statistics, issue the following command:

`ginim-stats|gs` *<slot-number>*

where:

<slot> Specifies the slot that contains the PowerCell module.

- On the PowerHub 7000, the slots are labeled on the PowerHub chassis.
- On the PowerHub 6000, the PowerCell 600 is always in slot 2.

On both PowerHub models, you also can determine the slot number using the **`mgmt showcfg`** command.

1. For information about the statistics you can display using the **`bridge stats`** command, see Section 2.8 in the *PowerHub Software Manual* (Rev B).

Here is an example of the information displayed by this command.

```
3:PowerHub:ginim# ginim-stats 4
GINIM stats of slot # 4:
---------------------------------
Packets Forwarded To PE (Slow)........... 6209
Packets Forwarded To PE (Fast)........... 0
Packets Forwarded Locally................ 2568
Bridge Filtered Packets ................. 0
IP Packets Received...................... 5393
IP Packets Forwarded Locally............. 2568
IP Packets Dropped (Bad Checksum)........ 0
IPX Packets Received..................... 3
IPX Packets Forwarded Locally............ 0
IPX Packets Dropped...................... 0
```

The **`stats`** command displays the following information:

`Packets Forwarded To PE (Slow)`

Number of packets forwarded by the intelligent module to the Packet Engine that were not processed on the intelligent module. The Packet Engine must perform all the processing for forwarding these packets. The term "`Slow`" refers to the fact that the system takes slightly longer to forward packets received by the intelligent module when the packets must be processed by the Packet Engine alone, rather than by both the Packet Engine and the dedicated resources of the intelligent module.

`Packets Forwarded To PE (Fast)`

Number of packets forwarded by the intelligent module to the Packet Engine that were processed by the intelligent module. The Packet Engine does not need to process these packets for forwarding. The term "`Fast`" refers to the fact that the system can forward packets received by the intelligent module faster when the packets are processed locally by the FDDI, Fast Ethernet, or ATM Engine on the intelligent module.

`Packets Forwarded Locally`

Number of packets locally forwarded by the intelligent module. (See Section 1.3.3.1 on page 15.)

`Bridge Filtered Packets`

Number of bridge packets received by the intelligent module segment that actually are destined for another node attached to the same segment. These packets are filtered out, rather than needlessly forwarded by the intelligent module.

`IP Packets Received`

Number of IP packets received by the intelligent module from its segments. IP packets are counted in this statistic regardless of whether they are forwarded to another segment on the intelligent module, are sent to the Packet Engine, or are discarded.

`IP Packets Forwarded Locally`

Number of IP packets locally forwarded by the intelligent NIM. (See Section 1.3.3.1 on page 15.)

`IP Packets Dropped (Bad Checksum)`

Number of IP packets dropped by the intelligent module because they had a bad IP-header checksum.

`IPX Packets Received`

Number of IPX packets received by the intelligent module from its segments. IPX packets are counted in this statistic regardless of whether they are forwarded to another segment on the intelligent NIM, are sent to the Packet Engine, or are discarded.

`IPX Packets Forwarded Locally`

Number of IPX packets locally forwarded by the intelligent module. (See Section 1.3.3.1 on page 15.)

`IPX Packets Dropped`

Number of IPX packets discarded by the intelligent module because the packets contained encapsulation errors.

NOTE: The IP and IPX statistics apply only to router traffic, not to bridge traffic. IP and IPX traffic forwarded in a VLAN is bridged, rather than routed, so that traffic is not included in these statistics.

B.4 CLEARING LOCAL PACKET-PROCESSING STATISTICS

To clear local-processing statistics, issue the following command:

ginim-stats-clear|gsc *<slot>*

where:

<slot> Specifies the slot that contains the PowerCell module.

- On the PowerHub 7000, the slots are labeled on the PowerHub chassis.
- On the PowerHub 6000, the PowerCell 600 is always in slot 2.

On both PowerHub models, you also can determine the slot number using the **mgmt showcfg** command.

As soon as the command is executed, the system clears the previously accumulated packet-processing statistics for all the intelligent modules in the system (except FDDI modules), then starts accumulating new statistics.

B.5 SETTING THE WATCHDOG TIMER

The watchdog timer is a diagnostic tool that checks the integrity of an intelligent module during a specified periodic interval. Unless you are having problems with the module, you do not need to change the setting of the watchdog timer. However, if FORE Systems TAC recommends that you change the setting of the timer, issue the following command:

ginim set-ginim-watch-dog|sgwd *<timer-value-in-seconds>*

where:

<timer-value-in-seconds>

Specifies the interval (in seconds) that the watchdog must wait before checking the intelligent modules. The minimum timer interval is 10 seconds. Do not specify an interval other than 10 seconds unless instructed to do so by the FORE Systems TAC. After five consecutive no responses to the watchdog's checks, the module that is not responding is rebooted.

If you specify no timer value, the current watchdog timer value is displayed. If you specify **0** seconds, the timer is disabled. The watchdog timer is disabled by default.

The following example shows the watchdog timer being set to check intelligent modules every 10 seconds.

```
3:PowerHub:ginim# set-ginim-watch-dog 10
GINIM watch dog timer is set to 10 seconds.
```

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